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A MICHIGAN LIMITED LIABILITY PARTNERSHIPMALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS

February 12, 1998

Ms. Mary Vanderlaan (313) 953-1425
Michigan Department of Environmental Quality
Environmental Response Division
38980 Seven Mile Road
Livonia, Michigan 48152

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FEB 17 1998

FILE _____
COUNTY _____

RE: Detroit Coke
Revised Site Evaluation Work Plan
Project 2420-108-H10

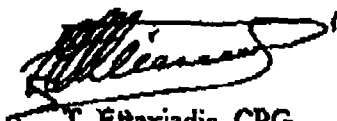
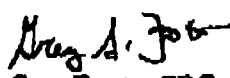
Dear Ms. Vanderlaan:

Attached please find the revised draft Work Plan to perform the Site Evaluations at the subject site. The Work Plan reflects the direction provided during our meeting on February 6, 1998 and further discussions on February 11, 1998. We are ready to finalize this document and prepare documentation for a project assignment upon receipt of your authorization to proceed.

If you have any questions, please feel free to contact me.

Very truly yours,

MALCOLM PIRNIE ENGINEERS, LLP


T. Etaxiadis, CPG
Project Manager
Greg Foote, CPG
Project Hydrogeologist

/ss

Enclosure

US EPA RECORDS CENTER REGION 5



1005145

**ATTACHMENT A
DETROIT COKE
WORK PLAN
SITE EVALUATION
February 12, 1998
2420-108-H10**

Background. The objective of this Site Evaluation is to obtain data at the Detroit Coke site to supplement existing information available to the Michigan Department of Environmental Quality (MDEQ) in assessing the nature of soil and groundwater contamination at the site.

Soil sampling and monitoring well locations will be determined by MDEQ and Malcolm Pirnie personnel prior to initializing field activities. Historical and current aerial photographs will be obtained and reviewed to determine sampling locations. The work activities to be performed by Malcolm Pirnie were discussed with MDEQ on February 6, and February 11, 1998, and are presented in the following sections.

Background information, is available in the MDEQ files, therefore it is not repeated in this document.

1. **Start-up Activities:** Prior to proceeding with drilling and sampling at the site, a short-form Site Safety Plan will be prepared for use by Malcolm Pirnie personnel and its subcontractors.

Access to all drilling and sampling locations will be obtained by MDEQ at least one week prior to the initiation of the drilling activities. Malcolm Pirnie will contact MISS DIG to locate underground utilities near the selected sampling locations.

A staging area will be set up near the barge mooring area to house the MDEQ mobile laboratory and to store drilling equipment. A security guard will be provided at the staging area during the non-working hours (approximately 6:00 p.m. to 6:00 a.m.).

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Drill cuttings will be used to backfill the unsaturated portion of the boreholes at each location. Any excess drill cuttings will be left at each drilling location. Drilling and sampling equipment will be decontaminated at the drilling locations. Decontamination fluids will not be containerized.

Field laboratory services will be provided by MDEQ's mobile laboratory; all other analytical services will be provided by MDEQ's laboratory in Lansing, MI, and/or by Malcolm Pirnie's contract laboratory ENCOTEC, located in Ann Arbor, MI.

2. **Surface Soil Sampling:** Surficial soil samples will be obtained from the upper 2-8 inches of the soil horizon at up to 100 locations, as well as from eight background locations. The Surficial soil sampling locations will be the same as those from which the deep soil samples will be collected (see Item 3 below). All Surficial soil samples will be analyzed for VOCs in the field by the MDEQ mobile laboratory. All samples will also be analyzed for cyanide, PNAs, and Michigan 10 metals by MDEQ's laboratory and/or ENCOTEC. Selected samples (approximately 20) will be analyzed for PCBs and Base-Neutral/Acid extractables (BNAs); samples to be analyzed for BNAs will not be analyzed for PNAs.

3. **Deep Soil Sampling:** Soil samples will be obtained from up to 100 boreholes at locations within the Detroit Coke site. One or two soil samples per location will be collected using a split spoon sampling device in boreholes drilled with 4 1/4 inch ID hollow stem augers, as follows:

- The first sample will be collected from the approximate middle of the unsaturated zone; the exact depth will be determined in the field based on the presence of highly stained soils, free product, and/or highly odiferous soils.
- The second sample will be collected from the unsaturated zone just above the water table.
- If the unsaturated zone is less than six feet thick, only one sample will be collected just above the water table.

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All samples will be analyzed by the MDEQ mobile laboratory for VOCs, and for Michigan 10 metals, cyanide and PNAs by MDEQ's laboratory or ENCOTEC. Selected samples (approximately 30) will be analyzed for PCBs and BNAs; samples to be analyzed for BNAs will not be analyzed for PNAs. Following completion of the soil boring, the boreholes will be backfilled with cuttings and the location will be staked and labeled.

4. Monitoring well Installation: Up to twenty shallow and three deep permanent monitoring wells will be drilled and installed at locations to be selected following review of the soil sampling field analytical data.

The shallow wells will be installed to intersect the water table (one foot of screen above water table) at soil sampling locations where the highest concentration of total VOCs or free product, are detected. For budgeting purposes it is estimated that the shallow wells will be installed to a depth of less than 15 feet below grade.

Preliminary data indicate that a second deeper sand unit is present beneath the upper sand unit (water table aquifer). Up to three deep wells will be installed into this deep sand unit to evaluate the presence and nature of groundwater contamination. For budgeting purposes it is estimated that the three deep wells will be installed to a depth of less than 60 feet below grade. The deep boreholes will be gamma ray logged through the augers prior to installation of the wells.

The permanent wells will consist of 5-foot-long-2 inch ID 10 to 15 slot PVC slotted screens and PVC risers. The joints between the well screen and the riser, and between the riser sections will be sealed with Teflon tape. A filter sand pack will be installed around the well screen, extending to two feet above the top of the screen. Well centralizers may be used to ensure that the screen is centered in the borehole. A one to two foot thick granular bentonite plug will be installed above the sand filter pack. The annular space of each well will be grouted with a bentonite grout from the top of the bentonite plug to 3 feet below grade. A rectangular above ground (stick-up) will be concreted in-place to 3 feet below grade, and will be fitted with a lock. Following installation, the wells will be developed by bailing or pumping.

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5. Survey: A location and topographic survey of the site will be performed to document current conditions, including ground surface elevations, buildings/tanks and other structures, and piles of waste and other material. A grid will be placed over the site to assist in locating soil borings and wells. Information obtained by the survey will also be used to estimate volumes of waste materials to be eventually removed.

The locations and the top of the well casing elevations will be surveyed by a registered surveyor to a USGS datum. In addition, the locations and ground and top of casing elevations of up to 8 existing monitoring wells (designated as piezometers in a previous report) located within the Detroit Coke site, will be similarly surveyed.

6. Groundwater Sampling and Aquifer Testing: One set of groundwater samples will be collected from the new and up to eight existing monitoring wells approximately one week following installation of the new wells. The samples will be collected using disposable bailers, following purging of at least three volumes of water from the wells. Up to five water samples may be collected from submerged site structures such as catch basins, concrete vaults, tanks, etc. The samples will be analyzed by the MDEQ laboratory for VOCs, BNAs, cyanide, PCBs, and Michigan 10 metals.

Prior to initiating the groundwater sampling, water levels in the wells will be measured and recorded using an electric water level probe. Field permeability tests will be conducted in three monitoring wells to be determined in the field, using the air slug method.

7. Report: A letter report will be prepared within one week following receipt of all soil and groundwater analytical data from ENCOTEC and the MDEQ laboratory. The report will present a short discussion of the work and procedures employed at the site, and will present the analytical data in tables and three figures. Soil boring and well construction logs, gamma ray logs, field permeability test data, and laboratory data will be presented in appendices

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Prepared for: AlliedSignal Inc.
101 Columbia Road
P.O. Box 1139
Morristown, NJ 07962-1139

Work Plan
Detroit Coke Facility - Detroit, Michigan
RCRA Facility Investigation
USEPA ID Number MID099114704

- *Project Management Plan*
- *Field Sampling Plan*
- *Data Management Plan*
- *Health & Safety Plan*
- *Quality Assurance Project Plan*

February 1998

Project No. 97444GL

Environmental Resources Management
1630 Heritage Landing Drive, Suite 100
St. Charles, Missouri 63303



February 10, 1998

Mr. Allen Melcer
U.S. Environmental Protection Agency
Region V
Underground Injection Control Branch (WU-16J)
77 West Jackson Boulevard
Chicago, IL 60604-3590



RE: Revised RFI Work Plan
Detroit Coke Facility - Detroit, Michigan
ERM Project No. 97444GL

Dear Allen:

Please find enclosed two (2) copies of the revised RFI Work Plan for the Detroit Coke Facility in Detroit, Michigan. Revisions to this document have been made based on two sets of comments received from United States Environmental Protection Agency (U.S. EPA) on August 4, 1997 and November 12, 1997, and our meeting at your office on November 4, 1997. The changes made to the previous RFI Work Plan dated April, 1996 have been incorporated into the various plans that comprise the work plan in bold text to make it easy for you to see the revisions. However, some responses to your comments are presented below to clarify certain issues and provide supporting information.

GENERAL AND SCOPE OF WORK COMMENTS ON BROWNFIELDS REDEVELOPMENT

Several of the general and scope of work comments in this section of your November 12, 1997 letter relate to action items presented in the Brownfields Redevelopment Plan for the site. Because the answers to many of your comments rely on the results obtained from the sampling and testing that will be performed as part of the RFI work plan, the best approach is to reserve judgment on these Brownfield issues until after the site information is obtained. Only two action items will be performed as part of the current work plan, the removal of tanks and coal tar in the Tar Tank Area SWMUs, and both of these serve as interim remediation measures. As for the other action items, we will be in a better position to

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discuss their implementation once the characterization activities in the revised RFI Work plan are completed.

SAMPLE PRESERVATION AND ANALYSIS, AND CLEANUP CRITERIA

Numerous conversations have been held between U.S. EPA and ERM concerning sampling and testing methods and the application of the old Michigan Act 307 or the new Part 201 standards to cleanup at the site. Suffice it to say that we are in a period of regulatory transition and need to consider all options available to bring the Detroit Coke facility back into beneficial reuse in a manner that is timely, cost-efficient, and protective of the environment.

For these reasons, the RFI Work plan specifies low level soil sample preservation and analytical reporting for the purpose of gathering the most useful data possible to assess risk posed by the site. This approach does not imply acceptance of lower risk or cleanup levels, but rather a desire to evaluate the broadest range of options when comparing future use with remediation alternatives.

The application of old Michigan Act 307 or new Part 201 of Act 451 cleanup criteria is a decision that can be deferred until the site is more fully characterized and the risk accurately assessed. However, we have based certain follow up actions in the RFI Work plan on Part 201 generic or site specific industrial cleanup criteria. Hopefully by the time we need to deal with these actions, the issues which affect the use of Part 201 criteria at the Detroit Coke facility will be resolved and we can move forward under these new regulations.

DETROIT COKE INDUSTRIAL ZONING

The question concerning zoning of the Detroit Coke property has been discussed with Ms. Sarah Lile at the City of Detroit. She indicated the site and surrounding area is zoned industrial with no apparent plans for rezoning. At my request, Ms. Lile is checking with the zoning department at the city to see if we can obtain a document verifying this status. In MDEQ Memorandum 14 of Part 201, zoning documentation is required in the form of a map or current property record card which shows the

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zoning status of the site and adjacent property. If the zoning department is unable to respond to Ms. Lile's inquiry, the zoning information under Part 201 will be obtained.

TRIMATRIX LABORATORY SOPs AND ANALYTICAL TABLES

Changes have been made in laboratory procedures since TriMatrix provided SOPs for the original RFI Work plan, and they continue to occur as evidenced by the soil preservation methods for VOCs under SW-846. However, TriMatrix has provided SOPs to U.S. EPA Region 5 and received approval on multiple projects since the Detroit Coke RFI Work plan was written. If necessary, TriMatrix will supply the names of other projects and their U.S. EPA project managers to verify the receipt and approval of these recent SOPs. Otherwise, TriMatrix will not resubmit SOPs to U.S. EPA for the Detroit Coke project unless specifically requested.

In addition to the TriMatrix SOPs, several comments in your August 4, 1997 letter dealt with analytical tables in the FSP and the QAPP. Responses to your questions on these tables are provided below. The tables in the revised RFI Work plan have not be changed unless it helped to clarify your comments. Otherwise, the tables are considered to be amended as follows.

Table 1-1 Summary of Sampling and Analysis Program

26. As described in the PMP and QAPP, soil sample depth in all cases is from 0 to 2 feet below grade. It is important to note that soil sampling in the Tar Tank Area SWMUs takes place after removal of residual tar in that area, so the actual sampling interval is 0 to 2 feet below the excavated depth.

The term "as amended" was used in this table to deal with any changes to the Site Target List based on results from the two expedited on-site samples and the one expedited background sample. The revised text should help clarify this point.

The additional SOPs were included originally for completeness before the parameters on the Site Target List

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were established. These additional SOPs can now be disregarded.

Table 6-1, Instrument Calibration, and VOCs SOP in Appendix A

- 27.a. Sample preservation procedures for VOCs in soil will be consistent with all recommended Target Method Detection Limits (TMDLs) as specified in Michigan Public Act (PA) 451 part 201. The Michigan Department of Environmental Quality (MDEQ) is currently in the final stages of the development and implementation of a new soil preservation procedure for use within Michigan. This new procedure is based on the protocols found in the newly released SW-846 procedure 5035. The MDEQ has indicated that the TMDLs currently presented in PA 201 will be revised to reflect the dilution factor which will result from the use of a methanol preservation protocol. As stated earlier, low level preservation and analytical reporting are specified in the RFI Work plan to maximize the value of information obtained.
- 27.b. All initial calibration curves generated by TriMatrix are verified by a method specified standard and a second source standard which is labeled as a Laboratory Control Sample (LCS). Table 6.1 should list our LCS criteria of $\pm 25\%$ for the initial calibration verification criteria for all compounds.
- 27.c. TriMatrix can perform a TIC scan for the top ten responding compounds for both methods 8260 and 8270 if required.

Table 6-1, page 2, and the SVOCs SOP

- 28.a. Table 6-1 is amended per these comments.
- 28.b. b. Yes. The initial calibration criteria for the SVOCs is the same as the VOCs - $\pm 25\%$ based on the analysis of a separate source LCS standard.
- 28.c. The table has been amended as requested.

Table 7-1 Analytical Methods and Detection Limits

29. The EPA regional guidance memorandum concerning proper sample preparation as written by Mr. David Payne was developed as a direct result of discussions with our laboratory during past Region 5 projects. This procedure was and is currently utilized by TriMatrix Laboratories on all soil samples.

Table 7-2 Sample Containers, Preservatives and Holding Times

30. The holding time until sample extraction for SVOCs is 7 days for water and 14 days for soils. Table 7-2 contains this information.

Table 7-3 Organic Parameters and Detection Limits

31. TriMatrix has performed MDL studies on both acetonitrile and acrylonitrile, demonstrating their ability to detect these compounds at the normal reporting limits of 50 ug/L and 1.0 ug/L respectively. As for the two volatile compounds, 2-chloro-1,3-butadiene and trans-1,4-dichloro-2-butene, both of these compounds are routinely analyzed by TriMatrix, and are subject to the same acceptance criteria as the other non-CCC and non-SPCC compounds for the initial calibration, initial calibration verification, and continuing calibration criteria. The most recent version of their 8260 SOP lists trans-1,4-dichloro-2-butene as an analyte, utilizing IS #4; 2-chloro-1,3-butadiene is normally reported by TriMatrix as a TIC only, but they do have the ability to calibrate and quantitate this compound, if required.
32. Diphenylamine has been added to TriMatrix's most recent version of the 8270 SOP, and is subject to the same initial calibration, initial calibration verification, and continuing calibration criteria as the other non-CCC and non-SPCC compounds. As for the methylphenols, the 3 and 4-methylphenols are reported as a sum rather than separate analytes. Table 7-3 is amended accordingly.

Table 8-1 Method Specific Data Quality Objectives Matrix Spike and Duplicate Control Limits

33. Section 11.5 of the SVOC SOP is written to indicate the volume of spiking solutions that is introduced into the sample prior to extraction. The actual spiking procedures are presented in the TriMatrix laboratory extraction SOPs. Copies of these procedures can be provided to U.S. EPA if requested.

Table 8-2, Method Specific Data Quality Objectives Surrogate Compound Percent Recovery Control Limits

34. Same as #33, above.

Field Sampling SOPs

There were also four comments in your first response letter that dealt with the Field Sampling SOPs. Consistent with our desire to limit the amount of information you need to review, responses to these comments are provided below. For this reason, the Field Sampling SOPs, like the other appendices in the QAPP, are not being reissued but are considered to be amended according to these responses.

HG-7, Version I Monitoring Well Purge and Sampling with a Bailer

35. The volume of the filter pack will be included when calculating the volume of standing water in the well.
36. The order of sample collection is VOCs first, then SVOCs, and finally metals as appropriate. This order is also specified in Section 6 of the Field Sampling Plan.

HG-3, Version I Permanent Wells Installed through Hollow Stem Augers

37. Bentonite seals will be allowed to hydrate whenever possible prior to grouting the remaining annular spaces.

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38. A side-discharging tremie pipe will be used whenever possible.

As a final item, TriMatrix has not yet been provided with performance evaluation (PE) samples from the U.S. EPA in conjunction with this project. The laboratory has analyzed numerous evaluation samples as part of both internal and external quality assurance programs. Copies of their most recent PE sample results are attached for your information.

Allen, these are the main comments that I wanted to address in this letter. Hopefully all other issues are covered in the revised RFI Work plan and we can gain your approval to proceed with the proposed scope of work as soon as possible. If you have questions or need clarification, please call me at 314/928-0300.

Sincerely,

ERM-NORTH CENTRAL, INC.



C. George Lynn
Senior Project Manager

/CGL

Enclosures

Detroit Coke Facility
Detroit, Michigan

Project Management Plan
RCRA Facility Investigation
USEPA ID Number MID099114704

February 1998

Project No. 97444GL

A MEMBER OF THE ENVIRONMENTAL RESOURCES MANAGEMENT GROUP

Environmental Resources Management
1630 Heritage Landing Drive, Suite 100
St. Charles, Missouri 63303



Detroit Coke Facility
Detroit, Michigan

Project Management Plan
RCRA Facility Investigation
USEPA ID Number MID099114704

February 1998

Project No. 97444GL

Environmental Resources Management
1630 Heritage Landing Drive, Suite 100
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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

Condition D of the Detroit Coke Corporation's Underground Injection Control (UIC) permit (number M1-163-1W-0004) identifies 13 SWMUs (solid waste management units) requiring possible investigation and corrective actions under the U.S. EPA's RCRA Corrective Action Program. In the RCRA Corrective Action framework, the purpose of a RCRA Facility Investigation (RFI) is to evaluate thoroughly the nature and extent of the release of hazardous wastes or constituents and to gather screening data to support the corrective measures study.

Of the 13 SWMUs identified by U.S. EPA at the Detroit Coke facility, 4 have been the subject of a Release Assessment (RA). Detroit Coke elected to conduct an RA at SWMUs 1, 2, 18 and 20, based on historical records and known housekeeping practices which suggest that a release has not occurred at these units. A report¹ summarizing the findings of the RA was approved by U.S. EPA in a letter dated December 13, 1995. Of the 4 SWMUs investigated during the RA, it was recommended that SWMUs 1, 2, and 20 be carried forward to the RFI phase of the corrective action program and SWMU 18 be dropped from further investigation during the RFI.

The remaining SWMUs have been grouped based on proximity and the materials handled. SWMUs 3, 5, 6, 19, and 21 have been grouped into the "By-Products Containment Area" and SWMUs 11, 12, and 13 have been grouped into the "Tar Tank Area". SWMU 15 will remain separate. The By-Products Containment Area, the Tar Tank Area, and SWMU 15 will be investigated as part of the scope of the RFI described herein. Additionally, SWMUs 1, 2, and 20 will be further investigated as recommended in the RA report.

In addition to the RA an Expanded Hydrogeological Investigation of the Detroit Coke Facility was conducted concurrently with the RA to provide greater understanding of the hydrogeology beneath the facility and the relationships between the ground water flow regimes and the two rivers which form the southeast and southwest perimeters of the site.

Based on the results of the two investigations mentioned above, a perimeter approach to the RFI ground water investigation has been recommended for this site for the following reasons:

¹ RCRA Facility Investigation Release Assessment, September, 1995

- The remaining SWMUs are in very close proximity to one another making the physical extent of an individual SWMU coincident with the adjacent SWMUs for all practical purposes;
- The hazardous constituents managed at the various SWMUs are similar to the degree that this similarity, and the proximity of the SWMUs to one another, precludes definitive determination of the source of a release on a SWMU specific basis;
- The facility, and the area in general, have been industrialized since the turn of the century enhancing the potential commingling of released constituents further limiting the potential to assign a release to a specific SWMU;
- Soils at the site exhibit ubiquitous nuisance level impact from nearly a century of air deposition of coal fines and other industrial byproducts and consequently site wide exposure controls constitute the most reasonable and cost effective corrective action for this medium;
- Ground water was not found to be within an aquifer used for potable supplies and or industrial uses;
- Ground water beneath the site was found to be limited to 2 thin saturated zones in the upper 50 feet of sediments underlying the site;
- The boundaries of the saturated zones in the downgradient direction are the Detroit and Rouge Rivers (in the horizontal dimension and are likely the discharge point for all ground water underlying the site) and in the vertical dimension the saturated zone is underlain by a thick interval of low permeability clay occurring anywhere from 10 feet below the ground surface distal from the rivers to 50 feet below the ground surface in proximity to the rivers;
- All SWMUs and remaining physical structures at the site are currently in the demolition process limiting their potential as an ongoing source; and
- Following corrective action to control exposures to soils at the site the only remaining reasonable and relevant exposure pathway for contaminants is via ground water discharging into one or the other of the adjacent rivers.

Consequently, in addition to defining potential direct human contact exposures to soil, the primary focus of the RFI will be to define ground water flow conditions at the perimeter of the site where there may be a potential for uncontrolled exposures to occur.

1.2 ORGANIZATION OF THE RFI WORK PLAN

In accordance with RCRA Corrective Action guidance, the RFI Work Plan will consist of an initial discussion of Current Conditions at the Site followed by a Preliminary Screening of Corrective Measure Technologies. These discussions and the fundamentals of the technical approach to the investigation, the schedule, and personnel that will be used during the RFI are presented in the Project Management Plan. The Project Management Plan is to be read in conjunction with the following support plans:

- Field Sampling Plan (FSP)
- Quality Assurance Project Plan (QAPP)
- Data Management Plan (DMP)
- Health and Safety Plan (H&SP)

These support plans outline the procedures which will be followed by **AlliedSignal Inc. (AlliedSignal)** and their consultant, **Environmental Resources Management (ERM)**, to ensure that all personnel, materials, and services necessary for, or incidental to, implementing the investigation are furnished. The scope of work presented in these project plans builds upon the existing environmental data and historical information available for the site.

A general overview of the contents of each plan and its location within this document follows:

1.2.1 *Project Management Plan (PMP)*

The Project Management Plan presents a discussion of the technical approach, scope of field activities, schedules, and personnel.

1.2.2 *Field Sampling Plan (FSP)*

The Field Sampling Plan describes all field activities, including detailed discussions of all sampling protocols.

1.2.3 *Quality Assurance Project Plan (QAPP)*

The Quality Assurance Project Plan, read in conjunction with the FSP, documents all monitoring procedures, sampling, field measurements, and sample analyses procedures that will be performed during the investigation. The QAPP will be followed to ensure that all information, data, and resulting decisions are technically sound, statistically valid, and properly documented.

1.2.4 Data Management Plan (DMP)

The Data Management Plan describes the documentation and tracking procedures for investigation data and results. The plan identifies data documentation materials and procedures, project file requirements, and project-related progress reporting procedures and documents. The format which will be used to present the raw data and conclusions of the investigation is also presented.

1.2.5 Health and Safety Plan (H&SP)

The Health and Safety Plan provides a brief description of the facility and known hazards; an evaluation of the health risks to workers implementing the field investigation activities; a list of key personnel and alternates responsible for site safety, response operations, and for protection of human health; a delineation of work areas; a description of the levels of personal protective equipment to be worn by personnel; established procedures to control site access; a description of documentation procedures for personnel on-site or visiting and for calibration of field screening equipment; established site emergency procedures; a description of requirements for an environmental surveillance program; a specification of any routine and special training required for responders; and established procedures for protecting workers from weather-related problems. The H&SP also address emergency medical care for injuries and toxicological problems and provides directions and a map to nearby hospitals.

The H&SP is consistent with appropriate NIOSH, OSHA, and U.S. EPA guidance documents.

2.0 DESCRIPTION OF CURRENT CONDITIONS

2.1 BACKGROUND

The Detroit Coke facility, located at 7819 Jefferson Avenue in Detroit, Michigan (Wayne County, T2S, R11E, Private Claim 67), occupies approximately 60 acres on the north side of the northern confluence of the Rouge and Detroit Rivers. The facility is in a heavily industrialized area along the Detroit and Rouge Rivers. Both rivers are used for transport of bulk materials by barge as well as recreational boating and fishing. A site location map is shown in Figure 2-1. Figure 2-2 is a site map that shows the general layout of the Detroit Coke facility.

Although the property immediately surrounding it is industrial, the facility is located approximately 1,000 feet southeast of a residential neighborhood; approximately 0.5 miles southeast of McMillian School; 0.5 miles southeast of Good Hope School; approximately 0.5 miles south of Cary School; 1.25 miles west of Prince Road Park; and about 1.75 miles west of a hospital near Sandwich, Ontario.

The Detroit Coke site was a coking facility which also produced coal tar and coke oven gas as byproducts. The coke was supplied to foundries for use as a fuel in cupolas; the coal tar was sold to a local coal tar refiner; and the coke oven gas was either used as a fuel on-site, sold, or flared.

Coking operations began at the facility in the early 1900's when the first battery of coke ovens was constructed. Detroit Coke **Corporation** has owned the facility since 1980. Detroit Coke operated the #4 battery from January 1980 until September 1991 when operations ceased and the plant was closed.

A Toxic Release Inventory for the Detroit Coke site was reported in 1990. The U.S. EPA has also prepared an RFA for the Detroit Coke facility. The RFA report, dated December 2, 1992, was based on materials found in facility and agency files, the preliminary RFA submitted by Detroit Coke **Corporation**, and the Visual Site Inspection performed by the agency on July 15-16, 1992. The U.S. EPA determined that the facility has 13 SWMUs requiring additional investigation and possible corrective action.

The facility is currently used to store and load bulk coal, coke, and limestone. Since the closure of coking operations, Detroit Coke **Corporation** has emptied and removed tanks, pipelines, and containment units at the facility. Select facility buildings **have also been demolished**. Interim Measures taken at the site pursuant to a RCRA Facility Assessment include:

- Accumulated coal tar residuals are being removed from SWMU 11;

- Underground lines such as coke oven gas lines have been removed;
- Pre-demolition asbestos abatement has been performed;
- No. 6 fuel oil tank has been removed; and
- Under contract to Detroit Coke **Corporation**, Murphy Demolition Inc. **has demolished** about 95% of site structures, including warehouses.

Through these demolition activities all SWMUs will be eliminated as potential ongoing sources of impact to human health and the environment.

2.2 LOCAL GEOLOGY AND HYDROGEOLOGY

The site topography is relatively flat with an elevation of around 590 feet above mean sea level. Ground surface at the site slopes gently toward the Detroit River to the east and the Rouge River to the south. Surface elevations range from about 590 feet MSL in the north to about 580 feet MSL adjacent to the rivers.

2.2.1 *Soils and Geology*

The site is located within a glacial lake plain once occupied by ancestral Lake Erie. The surficial geology of the site consists of fill material underlain by approximately 100 feet of glacial deposits including alluvial deposits, lacustrine and deltaic sand, lacustrine clay, and lacustrine and deltaic loam. These sediments were deposited during the Wisconsin stage of the Pleistocene glaciation, and are related to the advance and withdrawal of the Erie-Huron ice lobe. Bedrock formations immediately underlying the glacial deposits consist of approximately 4,000 feet of Paleozoic sedimentary deposits which dip northwest at approximately 30 feet/mile.

2.2.2 *Ground Water*

The uppermost permeable unit at the site is the surficial fill material of approximately 10-15 feet in thickness. Perched ground water is present at depths as shallow as 3 feet within this unit, but more typically exists at depths of 10 to 15 feet. Alluvial deposits consisting primarily of silt and clay; along with glacial lake plain deposits of clay and varying amounts of sand exist beneath the fill layer over most of the site. Ground water in varying quantities occurs within these units. The regional ground water flow is to the south and southeast toward the Detroit and Rouge Rivers.

Public drinking water is obtained primarily from surface water sources and supplied by the Detroit Metro Water Department. The surface water sources

include Lake St. Claire, Detroit River, Clinton River, River Rouge, Huron River and inland lakes. There are some private wells in the area that obtain water from the glacial deposits, either the Berea Sandstone or the Sylvania Sandstone Formations.

2.3 BROWNFIELDS REDEVELOPMENT OF THE SITE

The Detroit Coke site is an excellent candidate for Brownfields Redevelopment because of its access to major transportation routes, proximity to the downtown area and neighboring industries, and overall size. Redevelopment is consistent with current industrial zoning for the area, and the site is part of the City of Detroit's tax relief "Renaissance Zone" designed to encourage revitalization of economically distressed areas.

A description of the Brownfields Redevelopment approach for the Detroit Coke site is provided in Section 2.3.1 as a series of action items. These items represent interim remedial measures, corrective measures, and long term monitoring events. Implementation of the action items depends on the results obtained from sampling and testing events presented in this RFI Work Plan. Consequently, the corrective measures presented in Section 3.0 will be dependent upon the redevelopment and future use of the site based on cleanup to MDEQ Part 201 generic or site specific industrial criteria.

To support the Brownfields approach, the U.S. EPA/MDEQ may be requested to approve a local ordinance prohibiting the use of ground water or other affected media. Also, restrictive covenants, for any area of the site where a limited closure is approved, will be used to assure the effectiveness and integrity of the corrective measures selected.

2.3.1 Brownsfields Approach

1. Excavate and remove residual coal tar in the Tar Tank Area SWMUs for recycling. Material will be removed from the Tar Tank Area (SWMU 11), the Trench Area (SWMU 12), and the Tar Pump House (SWMU 13) until the underlying fill dirt is encountered, or until a depth of two feet (the estimated depth of surface soil) is achieved. Excavation below this depth may not be possible due to the shallow depth of ground water in the vicinity of the Tar Tank Area SWMUs.
2. Remove tar from the three existing above ground tanks at the site. When completed, the tanks will be removed and scrapped for steel recycling. Any visible rail lines still in place at the site will also be removed for scrap steel.

In addition, remaining buildings at the site will be demolished and resulting debris removed as necessary.

3. Place tar and coke processing materials from the By-Products Containment Area SWMUs in the excavated Tar Tank Area SWMUs if deemed necessary and appropriate based on the proposed soil sampling and testing. This serves the dual purpose of consolidating impacted material at the site, and returning the TAR Tank Area SWMUs to grade for drainage control.
4. Place and compact two feet of clay fill, currently stockpiled on site, over the Tar Tank Area SWMUs. This fill was brought to the property from a nearby construction site and has been tested to be a clean clay-rich material.
5. Grade the entire property, using demolition debris stockpiled at the site during removal of plant facilities and additional off-site clean fill as needed, to promote storm water drainage and deter infiltration.
6. Upgrade and maintain the existing well network to monitor groundwater quality at the site. The upgrades include installing two wells along the downgradient edge of the property to complete a perimeter monitoring network, and two additional wells, one upgradient and one downgradient of the Tar Tank Area SWMUs, to evaluate the impact on groundwater from this specific area. The latter two wells will not be part of the perimeter monitoring network.

All wells will be screened from the water table surface to the top of the first confining clay so that both petroleum hydrocarbons and coal tar residues can be monitored in the shallow water table unit. Geological and hydrological information will also be collected during well installation. In the event there is impact to groundwater quality detected at the property boundary at levels above Part 201 generic or site specific industrial cleanup criteria, or groundwater cleanup is initiated for the Detroit metropolitan area, AlliedSignal will address groundwater conditions at the site. Perimeter monitoring will be performed on a quarterly basis for a period of one year. Monitoring after the first full year will be based on the results obtained (see Section 4.2) and as agreed upon by AlliedSignal and U.S. EPA.

7. Develop institutional controls and deed restrictions that apply to the future use of the property. These include elements such as perimeter fencing, access gates, building restrictions for impacted areas, restrictive covenants, and health and safety protocols for construction employees that may work at the site.
8. Perform post-grading risk assessment and sampling if deemed necessary. Implementation is dependent on actual site conditions encountered during

the restoration process, at which time a decision can be made as to whether either activity adds value to the potential redevelopment of the site.

2.3.2 *Benefits of Redevelopment*

The action items listed above are aimed at managing site contamination by mitigating the potential exposure pathways that could impact human health and the environment, and preparing the property for redevelopment. The future use of the property will also take these pathways into account, and has the potential to further limit exposure through the construction of parking lots, building foundations, and other covered areas.

The Brownfields approach addresses the two issues of concern expressed in this RFI Work Plan: potential direct human contact exposure to soil, and the potential for uncontrolled exposure in ground water at the perimeter of the site. Redevelopment has the added potential to eliminate other exposure pathways such as fugitive dust emissions and release to surface waters through implementation of the Brownfields approach and future construction activities (building foundations, asphalt paving, and landscaping). A summary of the benefits derived from the Brownfields Redevelopment Plan are listed below.

2.3.3 *Impacted Materials and Coal Tar Wastes*

It is a known fact that this part of the Detroit and Rouge River waterfront was landfilled during the early part of the century to accommodate industrial growth in the Detroit area. Fill material of unknown origin and character was brought to Zug Island and the adjacent properties, some of which may have been other industries' wastes and byproducts. Any attempt to separate formerly impacted fill from wastes generated by on-site operations would be a difficult if not impossible task, and would conceivably require excavation of the entire Zug Island area to a depth of several feet below the water table to achieve uniform cleanup.

Realizing the impracticability of this task, removal of stored tar wastes for recycling eliminates potential source material from the site, and consolidation followed by capping further reduces the potential for exposure and ground water impact. This approach specifically addresses exposure pathways to protect human health and the environment, and promotes contamination management on-site rather than transferring liability to an off-site location. An additional benefit is minimizing the disturbance of on-site materials that are old and degraded, which also reduces adverse affects to workers on the property and neighboring businesses.

2.3.4 *Ground Water*

Ground water management is a key to any successful redevelopment program. At the Detroit Coke site, ground water is as shallow as two feet below surface, and slopes in an easterly direction towards the Detroit and Rouge Rivers. Fill material at the site extends to an average depth of ten feet below surface, and is in turn underlain across most of the site by a thick layer (40 feet) of natural clay. It is unlikely that shallow ground water contained in the fill material will ever be developed into a resource. Based on these facts, ground water at the site is best managed using a perimeter monitoring approach.

Impacted ground water identified through previous investigation activities has been limited to a single occurrence of creosote-like product in an apparent upgradient well, and benzene at trace levels in the northern part of the site. Upgrading the existing well network by the addition of selected wells near the Tar Tank SWMUs and along the downgradient perimeter will provide adequate monitoring of both these occurrences.

Coal tar residues are persistent and relatively immobile in the subsurface. Monitoring their presence, and especially the potential migration from an off-site source, is a proven and accepted method of ground water management for liquid tars, especially considering their difficulty for recovery using conventional technologies.

The attenuation of benzene and other light fractions has been successfully demonstrated in-situ through intrinsic bioremediation. The proposed monitoring well network in Section 4.2 is well-suited to monitor and track the biodegradation of benzene across the property.

Proposed wells in this work plan are designed to monitor the shallow water table zone. Only one round of sampling and testing has been completed for selected wells screened in this zone, resulting in the limited occurrence of chemical constituents mentioned above. As described in Section 4.2, a one year period of quarterly sampling and testing of the proposed perimeter monitoring well network in the shallow water table zone is recommended before implementing a deeper well installation and monitoring program.

2.3.5 *Class I Injection Wells*

Two Class I injection wells are located near the western boundary of the property. Detroit Coke Corporation has used these wells for the injection of waste byproducts from the coking industry. Although the future use of the wells is uncertain at this time, three options exist from a Brownfields perspective:

- The wells can become an integral part of new businesses at the site for handling liquid wastes generated through facility operations and from storm water runoff;
- The wells can be used as part of a groundwater remediation system in the event contamination is encountered that has to be mitigated; and
- The wells can be properly closed and abandoned.

The eventual use of the two Class I injection wells will be determined independent of the RFI Work Plan.

3.0 PRELIMINARY EVALUATION OF CORRECTIVE MEASURES TECHNOLOGIES

3.1 INTRODUCTION

Consistent with the requirements of the RCRA Corrective Action Plan prepared for the Detroit Coke site, this document identifies potential corrective measure technologies that may be used at the facility or beyond the boundaries of the facility, if necessary, to respond to releases of hazardous waste or hazardous constituents at or from the facility. This document has been prepared in support of the Project Management Plan (PMP).

The Detroit Coke facility, located at 7819 Jefferson Avenue, in Detroit, Michigan is a large industrial site which is currently used to store and load bulk coal, coke, and limestone. A discussion of background and available site information as well as a summary of past site investigation activities regarding the nature and extent of the impacts at the site are presented in the PMP and the RCRA Facility Release Assessment Investigation Report (RA Report).

Potential corrective measure technologies for impacted soils and ground water at the Detroit Coke site have been identified herein. The potentially applicable corrective measure technologies were identified based on the existing information regarding the facility background and the types of constituents of concern which may be present in site soils and ground water. The following is a presentation of the preliminary evaluation of potentially applicable corrective measure technologies.

3.2 POTENTIALLY APPLICABLE CORRECTIVE MEASURE TECHNOLOGIES

A number of technologies are available for remediation of impacted environmental media on the site. Impacted environmental media of specific concern include soils and ground water which have been shown to be impacted with volatile and semi-volatile organic constituents (VOCs and SVOCs) as a result of the initial sample collection and analysis performed for the RCRA Facility Investigation and as summarized in the RA Report. A discussion of applicable technologies based on the type of constituents which may be present in the soils and ground water is presented in Sections 3.2.1 and 3.2.2.

In addition, corrective measure technologies have been presented which are potentially applicable for the recovery of non-aqueous phase liquids (NAPL) or free product which may be present at the site. A summary of applicable technologies for recovery of free product is presented in Section 3.2.3.

3.2.1 Soil

As summarized in the RA Report, VOCs and SVOCs have been detected in soil samples collected at the Detroit Coke site. This document evaluates corrective measures for soils impacted by VOCs, however, no VOCs were detected in soils collected at the Detroit Coke facility at concentrations which exceeded generic residential direct contact criteria. Therefore, none of the technologies evaluated herein may be required for treatment of soils impacted with VOCs.

3.2.1.1 Soils Impacted by Volatile Organic Compounds

VOCs have the potential to migrate to other environmental media by virtue of their volatility and relative mobility. However, VOCs can be removed from soils fairly readily by proven technologies that can be performed once impacted soils have been excavated and by more innovative technologies which are effective in removing VOCs *in situ* or in place. VOCs present in soils at the site may include the following: benzene, toluene, ethylbenzene, and xylene(s). A summary of remedial technologies and process options potentially applicable for remediation of soils impacted by VOCs is presented in Table 3-1.

If necessary, selection of an appropriate measure for soils impacted by benzene, toluene, ethylbenzene, and xylene(s) will be based on the quantity of impacted soils present, the concentrations of these constituents in the soils, the presence or absence of other constituents of concern in the soils, and other site-specific considerations (e.g., potential exposure routes).

3.2.1.2 Soils Impacted by Semi-Volatile Organic Compounds

SVOCs are much less likely to migrate through soils and impact other environmental media than the more mobile VOC constituents cited above. Although SVOCs are less mobile and volatile, there are proven technologies which are effective at treating soils impacted with SVOCs. SVOCs detected in soil samples collected at the site include the following: benzo(a)anthracene, benzo(a)pyrene, benzo(b&k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene.

Table 3-2 presents a summary of remedial technologies and process options potentially applicable for remediation of soils impacted with SVOCs. Although this document presents a preliminary evaluation of corrective measure technologies, it is anticipated that corrective measures for soils impacted by SVOCs, if necessary, will consist mainly of exposure control measures. If necessary, selection of an appropriate corrective measure technology or technologies for soils impacted at the site will be based on the quantity of impacted soils present, the concentrations of SVOCs in the soils, the estimated

costs for implementation of the various technologies, and other site-specific considerations (e.g., depth and location of impacts, presence of structures, etc.).

3.2.2 Ground Water

3.2.2.1 Ground Water Impacted by Volatile Organic Compounds

Due to the volatile nature of VOCs, there are conventional technologies which can be used to extract and treat ground water impacted with VOCs as well as more innovative technologies which can treat ground water in situ. VOCs present in ground water at the site may include benzene, toluene and xylene(s). A summary of potentially applicable corrective measure technologies and process options for remediation of ground water impacted with VOCs and is presented in Table 3-3.

If necessary, treatment methods for ground water impacted by VOCs will be based on the amount of ground water requiring treatment to effectively provide containment of the impacted ground water, the concentrations of VOCs in the ground water, the presence of other constituents in ground water, the presence or absence of NAPL in the ground water, and other site-specific considerations.

3.2.2.2 Ground Water Impacted with Semi-Volatile Organic Compounds

SVOCs which have been detected in ground water samples collected at the site include acenaphthalene, fluorene, naphthalene, phenanthrene, and pyrene.

A list of potentially applicable technologies and process options for SVOCs in ground water is presented in Table 3-4. If necessary, treatment methods for ground water impacted by SVOCs will be based on the extent of SVOC impact to ground water, the concentrations of SVOCs in the ground water as well as concentrations of other constituents of concern in ground water, the estimated costs for implementation of the various technologies, and the presence or absence of a NAPL.

3.2.3 Free Product

As indicated in the RA Report , free product has been demonstrated to be present in the ground water at the Detroit Coke site. A summary of the potentially applicable corrective measure technologies for recovery of free product is presented in Table 3-5.

As with impacts to other environmental media, the technologies implemented for removal of NAPL will be based on the quantity of NAPL present at the site, the estimated costs for implementation of the various technologies, and other site-specific considerations.

The responsibilities of each member of the project team are summarized below.

4.1.1 *Management Responsibilities*

- *U.S. EPA RFI Project Coordinator:* The U.S. EPA Project Coordinators, **Allen Melcer and Greg Rudloff**, **share** the overall responsibility for regulatory oversight of all phases of the RFI scope of work.
- *AlliedSignal RFI Project Manager:* **Tim Metcalf**, the **AlliedSignal** RFI Project Manager, is responsible for implementing the project, and has the authority to commit the resources necessary to meet project objectives and requirements. The **AlliedSignal** RFI Project Manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The **AlliedSignal** RFI Project Manager will report directly to the U.S. EPA RFI Project Coordinator and will provide the major point of contact and control for matters concerning the project. **He will also coordinate on-site activities with Paul Choinski of Detroit Coke Corporation.** The **AlliedSignal** RFI Project Manager will:
 - define project objectives and develop a detailed work plan schedule;
 - establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
 - acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints;
 - orient all field leaders and support staff concerning the project's special considerations;
 - monitor and direct the field leaders;
 - develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
 - review the work performed on each task to ensure its quality, responsiveness, and timeliness;
 - review and analyze overall task performance with respect to planned requirements and authorizations;
 - approve all external reports (deliverables) before their submission to U.S. EPA Region 5;

- ultimately be responsible for the preparation and quality of monthly progress reports, draft and final design specifications, and final construction report; and
- represent the project team at meetings and public hearings.
- *ERM RFI Project Manager: C. George Lynn, C.P.G.*, is the ERM RFI Project Manager. At the discretion of the **AlliedSignal** RFI Project Manager, a number of the **AlliedSignal** RFI Project Manager's responsibilities may be directly delegated to the ERM RFI Project Manager. The ERM RFI Project Manager will provide direction for the entirety of the ERM project team and be responsible for communications and project deliverables to **AlliedSignal**. Responsibilities held jointly with the **AlliedSignal** RFI Project manager will include:
 - approval of all external reports (deliverables) before their submission to U.S. EPA Region 5;
 - the preparation and quality assurance of monthly progress reports, draft and final design specifications, and final construction report; and
 - representation of the project team at meetings and public hearings.
- *ERM RFI Technical Manager: Randy Cooper, P.E.*, is the ERM RFI Technical Manager. At the discretion of the **AlliedSignal** RFI Project Manager, a number of the **AlliedSignal** RFI Project Manager's responsibilities may be directly delegated to the ERM RFI Technical Manager. Responsibilities held jointly with the **AlliedSignal** RFI Project manager will include:
 - acquisition and application of technical and corporate resources as needed to ensure performance within budget and schedule constraints;
 - monitoring and directing the field leaders;
 - developing and meeting ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
 - review of the work performed on each task to ensure its quality, responsiveness, and timeliness; and
 - review and analysis of overall task performance with respect to planned requirements and authorizations.

4.1.2 *Quality Assurance Responsibilities*

- *U.S. EPA Region 5 Quality Assurance Manager (RQAM):* EPA RQAM has the responsibility to review and approve all Quality Assurance Project Plans (QAPPs).

Additional U.S. EPA responsibilities include:

- Conducting external Performance and System Audits of the TriMatrix Environmental Laboratory; and
- Reviewing and evaluating analytical field and laboratory procedures.
- *ERM RFI QA Director:* The **ERM RFI QA Director** is **John Imse, P.G.**. The QA Director will remain independent of direct job involvement and day-to-day operations, and have direct access to corporate executive staff as necessary to resolve any QA dispute. He is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, **ERM's** policies, and U.S. EPA requirements. Specific functions and duties include:
 - providing QA audit on various phases of the field operations;
 - reviewing and approval of QA plans and procedures;
 - providing QA technical assistance to project staff; and
 - reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the **ERM RFI Project Manager**.
- *TriMatrix RFI Laboratory Quality Assurance Officer:* The TriMatrix RFI Laboratory Quality Assurance Officer is **Rick Wilburn**. As Laboratory QA Officer he:
 - oversees laboratory quality assurance;
 - oversees laboratory QA/QC documentation;
 - conducts detailed laboratory data review;
 - decides laboratory corrective actions, if required;
 - presents technical laboratory QA procedures;

- prepares laboratory standard operation procedures; and
- ensures that the laboratory protocols specified in the QAPP are followed.

4.1.3 *Laboratory Responsibilities*

- *TriMatrix RFI Laboratory Operations Manager:* The TriMatrix RFI Laboratory Operations Manager is **Doug Kriscunas**. As Laboratory Operations Manager, Mr. **Kriscunas**:
 - ensures all resources of the laboratory are available on an as-required basis;
 - oversees final analytical reports; and
 - ensures that the protocols specified in the QAPP are followed.
- *TriMatrix RFI Laboratory Project Manager:* The TriMatrix RFI Laboratory Project Manager is **Jennifer Rice**. As Laboratory Project Manager, she:
 - coordinates laboratory analyses;
 - supervises in-house chain-of-custody;
 - oversees laboratory data review;
 - oversees preparation of analytical reports; and
 - approves final analytical reports prior to submittal to **ERM**.
- *TriMatrix RFI Laboratory Sample Custodian:* The TriMatrix Laboratory Sample Custodian is **Keith Banschoff**. As Sample Custodian, he:
 - receives and inspects the incoming sample containers;
 - records the condition of the incoming sample containers;
 - signs appropriate documents;
 - verifies chain-of-custody and its correctness;
 - notifies Laboratory Project Manager of sample receipt and inspection;

- assigns a unique identification number and customer number, and enters each into the sample receiving log;
- initiates, with the help of the Laboratory Project Manager, transfer of the samples to appropriate laboratory sections; and
- controls and monitors access/storage of samples and extracts.

Independent Laboratory Data Validation will be provided by **Kathleen A. Blaine**. Ms. Blaine is a **Senior Quality Assurance Chemist with Environmental Standards, Inc.**, a firm which specializes in the field of data validation. Ms. Blaine has over 11 years of experience as a data validation specialist. She is also experienced in laboratory auditing and bench chemistry analysis.

The primary responsibility for project quality rests with the AlliedSignal RFI Project Manager in conjunction with the ERM RFI project team. Independent quality assurance will be provided by the TriMatrix RFI Laboratory Project Manager and the ERM RFI QA Director prior to the release of data packages.

4.1.4 Field Responsibilities

- **ERM RFI Coordinator:** ERM RFI Coordinator, **Doug Burge, P.G.**, will be supported by the ERM technical and field staff. He will be responsible for leading and coordinating the day-to-day activities of the various resource specialists under her supervision. The ERM RFI Coordinator is a highly experienced environmental professional and will report directly to the ERM RFI Technical Manager. Specific ERM RFI Coordinator responsibilities include:
 - implementation of field-related plans, assurance of schedule compliance, and adherence to management-developed study requirements;
 - coordination and management of field staff including sampling and subcontractors;
 - implementation of QC for technical data provided by the field staff including field measurement data;
 - adherence to work schedules provided by the ERM RFI Technical Manager;
 - authorship, review, and approval of text and graphics required for field team efforts; and

- identification of problems at the field team level, discussion of resolutions with the ERM RFI Technical Manager, and provision of communication between project team members and upper management.
- *ERM RFI Technical and Field Staff:* The ERM RFI technical and field staff for this project will be drawn from ERM's multi-disciplinary corporate resources. The technical and field staff will be utilized to gather and analyze data, and to prepare various task reports. All of the designated technical and field team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

4.2 TECHNICAL APPROACH

The technical approach for this RFI has been summarized in the Release Assessment (RA) Report as focusing primarily on a perimeter ground water investigation with SWMU specific ground water and soil quality investigation limited to that necessary to support a risk assessment and design appropriate exposure controls for this media. U.S. EPA has agreed with this approach, in concept, although the agency cautions that some additional SWMU specific ground water sample collection and analysis may be necessary based on results of the perimeter investigation. With this in mind, additional ground water monitoring well locations beyond those recommended by the RA, have been proposed downgradient of the two large SWMU areas ("By-Products Containment Area" including SWMUs 3, 5, 6, 19, and 21 and the "Tar Tank Area" including SWMUs 11, 12, and 13) and SWMU 15.

The RFI will also focus on defining potential direct human contact exposures to soil. The concentration of chemicals of concern in the surface soil (defined as 0-2 feet) at the SWMUs will be investigated to determine the potential for completion of current and future soil exposure pathways for on-site populations. Sampling and analysis will be done to obtain soil characterization data necessary to perform a risk assessment and support the corrective measures study and **Brownfields Redevelopment approach.**

Factors that have been considered in the selection of the sampling points and media for the RFI are as follows:

- the likely mechanism of release;
- the characteristics of the materials managed in the unit (mobility, volatility, miscibility, solubility, and other relevant characteristics); and

- characteristics of the site that affect contaminant fate and transport (topography, lithology, stratigraphy, hydrogeology, etc.).

Given the long industrial history of the site and the region in which it is located, the technical approach for this RFI has also taken into account a fourth factor: characteristics of the site and region that have a significant potential for causing analytical interference during the course of the RFI. Such characteristics include: current and historical uses of the site and adjacent properties, the prevalence of fill materials in the area, proximity to large air emission sources, etc.

The sampling and analysis strategy for the RFI has been designed to identify the existence of constituents of concern in environmental media (due to past releases from the SWMUs) at the endpoints of relevant exposure pathways. The relevance of the exposure pathways is based on consideration of the four factors above and upon a generalized plan for future site use(s) (Current Conditions, Section 2).

The technical rationale for the strategy is summarized below and described in greater detail in the sections which follow.

Sampling Locations

Soil

As outlined in the RA report recommendations, no additional soil sampling will be conducted at SWMUs 1, 2, or 20.

Sampling of surface soils will be performed during the RFI at all other SWMUs (Tar Tank Area, By-Products Containment Area, and SWMU 15) to support a risk assessment and corrective measures study to determine appropriate exposure control mechanisms for site soil media **consistent with an industrial redevelopment approach**. Since most of these SWMUs employed secondary containment, impact to soils is expected to be the result of incidental spillage and/or general manufacturing processes. Consequently, soil sampling will be focused on the areas immediately outside the former secondary containment features.

Because most of the superficial structures associated with the SWMUs have been demolished, the RFI will include additional limited sampling of surface soils formerly beneath the secondary containment structures. It is important to note that soil sampling in the vicinity of the Tar Tank Area SWMUs will be conducted after removal of residual tar as described in Section 2.3 - Brownfields Redevelopment of the Site. The sampling will serve to

characterize the underlying soil following completion of this interim remedial measure of source removal.

MDNR guidance² was followed to estimate the number of samples required to obtain a statistically representative data set for each SWMU, based on areal extent. Given the area of the Tar Tanks Area (about 250 by 250 feet) sampling on a 50-foot grid **after residual tar removal** would provide a sufficient representative data set. The By-Products Area is slightly smaller given that the concrete pad is the southern portion of this area will remain in place.

Sample placement be will done only roughly on a grid system, employing some bias which emphasizes placement of sample locations in the areas immediately adjacent to the former locations of the secondary containment structures since the potential mechanism of release from the SWMUs in these areas can be inferred with some confidence. Given the small area of SWMU 15 (<2,000 square feet) soil samples will be collected from 5 locations. All surface soil samples will be field screened for appearance and total volatile organic compound (VOC) content. Laboratory analysis will be done on 9 of the 35 samples (25%) from the Tar Tank Area SWMUs, 6 of 22 (25%) from the By-Products Containment Area SWMUs, and all of the surface soil samples collected at SWMU 15.

Figure 4-2 shows the proposed surface soil sample locations.

Ground Water

Consistent with the objectives of the RFI Work Plan, ground water sampling and testing will be focused on the perimeter of the site. The monitor well network will be completed through the installation of two wells, one along the River Rouge and the other along the Detroit River. These two new wells, together with existing wells and piezometers (P-4S, P-3S, P-2S, MW-5, P-6D, P-1S, and P-5S), comprise the perimeter monitoring network for the site. Groundwater from this network will be sampled and analyzed as described in the Field Sampling Plan on a quarterly basis for a period of one year. Once a full year of groundwater analytical data have been obtained, the need for and frequency of any future monitoring will be reviewed with the U.S. EPA.

The Expanded Hydrogeological Investigation showed that there are two independent water bearing strata beneath the site; a thin shallow water table unit and a deeper confined sand unit, separated from one another by a clay layer. The proposed perimeter monitoring network will evaluate the potential for impact on the shallow water table unit. In the event chemical constituents are encountered in groundwater samples from the shallow water table unit at levels above Part 201 generic or site specific industrial cleanup criteria, the

² *Guidance Document for the Verification of Soil Remediation*, April 1994.

need for monitoring wells in the deeper sand unit will be reviewed with the U.S. EPA RFI Project Coordinator.

If monitoring in the deeper unit is deemed necessary, the number and location of wells will be submitted to the U.S. EPA for review and approval. An important consideration for monitoring wells in the deeper sand unit is avoiding cross-contamination of aquifer units during and after installation. This concern will be taken into consideration as part of the evaluation of the need for monitoring wells in the deeper aquifer unit, along with the potential for impact to the deeper aquifer unit from off-site sources.

In addition to serving as part of the perimeter monitoring network, the two new wells along the Detroit and Rouge Rivers will also serve as downgradient monitoring locations for the Tar Tank and By-Products Containment Area SWMUs, as well as SWMU 15. Because creosote-like material was encountered during the installation of piezometer P-6D, two other wells will be installed, one upgradient and one downgradient of the Tar Tank Area SWMUs. These two wells will be completed in the shallow water table aquifer unit to evaluate the Tar Tank Area SWMUs as a potential source for the creosote-like material encountered in piezometer P-6D.

To address U.S. EPA's specific concern with groundwater discharge, one sample will be collected in the granular backfill from each of the two outfalls at the site near their discharge to the Detroit and Rouge Rivers. These two samples will be collected during the first round of perimeter well sampling, and analyzed for the same constituents as the perimeter wells.

Figure 4-3 illustrates the locations of the proposed monitoring well clusters.

Sampling Frequency

Soil

The number of samples collected at each unit will be dictated by the needs of the risk assessment and in support of the corrective measures study/**Brownfields Development approach** which will identify the necessary exposure control mechanisms for soils at the site. Michigan Department of Natural Resources (MDNR) *Guidance for the Verification of Remediation* (April 1994; Appendix A) will be used as a basis for constructing a statistically sound sampling strategy. This guidance employs statistical techniques premised on the size of the unit to specify the number of samples that must be collected to draw conclusions regarding the absence of a release. The guidance also specifies field screening and other techniques, mentioned previously, that may be used to bias sample locations towards areas of highest probability of impact.

However, upon consultation with the analytical laboratory's project manager, the aforementioned matrix interference is more likely attributable to elevated analyte concentrations within the sample(s), the consequence of this is that the samples must be diluted prior to analysis. The sample dilution process results in the elevation of analytical detection limits; this is subsequently termed "matrix interference". The term "matrix interference" is somewhat of a misnomer however, and as a result, simply analyzing for a more comprehensive list of compounds, (e.g., the Appendix IX constituent list) will not eliminate the frequency nor the magnitude of matrix interference.

A tremendous amount of information has been published regarding the coking process, some of which dates back to the nineteenth century. Screening a small portion of this information allows a reader to appreciate the complexity and variability of the organic constituent matrix generally found in coal tars resulting from the coking process. However, many of the organic compounds typically associated with coal tar are found on the constituent list of U.S. EPA Methods 8260 and 8270, which are the volatile and semivolatile analytical methodologies, respectively, proposed for use during this RFI.

It is the opinion of **AlliedSignal** that historical operations at each of the SWMUs under investigation during the RFI have been thoroughly reviewed. As a result, the waste likely to have been managed at each SWMU is of known content, having previously undergone characterization in support of the UIC permit and/or as needed for disposal purposes.

Accordingly, soil sample analysis for the Appendix IX constituent list will not benefit this project. Matrix interference was not significant in ground water samples analyzed during the RA, and therefore, ground water will not be analyzed for Appendix IX parameters.

4.2.1 Soil Technical Approach

The quality of the surface soils at the SWMUs will be characterized through sampling on a rough grid pattern with sample locations being biased toward the areas with the presumed highest potential for SWMU-related contamination (around the perimeter of the former secondary containment structures). Soil samples will be collected from the upper two feet in the **By-Products Containment SWMUs and SWMU 15. Soil samples will be collected immediately below the excavated depth in the Tar Tank Area SWMUs.** Soil samples will be field screened for visual evidence of impact and for total VOC content.

Field Screening

All soil samples will be field screened for evidence of impact. Immediately upon collection, each soil sample will be split and one portion will be preserved for potential laboratory analysis; the other portion will be field screened visually for evidence of impact (staining) and for total volatile organic compound vapors (VOCs) using a photoionization detector (PID).

A PID measures the total concentration of volatile organic vapors (≥ 1 ppm) emitted from compounds (non chemical-specific) in the media being screened with an ionization potential less than that of the lamp used by the PID. Generally, a 10.6 or 11.7 eV lamp is used. A 10.6 eV lamp (to be used during this RFI) is highly sensitive to BTEX compounds and pyridine, which are essentially the volatile organic indicator compounds of interest. For the purposes of the RFI, a PID for determination of the relative presence of VOCs, in combination with visual and/or olfactory responses for the determination of the relative presence of oil or coal tar, will be used to assist in selecting a sample for laboratory analysis. It is not intended that the PID results specify individual compounds nor detect a wide variety of compounds; rather, the PID is expected to provide a relative response when compared to ambient air concentrations, thereby, indicating that a sample likely contains or does not contain vapors indicating the presence of VOCs.

Field screening results will be noted in the field logbook and the preserved soil samples will be held for potential laboratory analysis. After collection of all samples from a particular SWMU area (Tar Tank Area or By-Products Area), 25% of the samples collected will be selected for laboratory analysis based on field screening results. Those samples showing the greatest evidence of potential impact will be selected. If there are not enough potentially impacted soil samples to constitute 25% of the total samples, the difference will be made up with samples selected at random. All samples from SWMU 15 will be analyzed in the laboratory.

Laboratory

The selected soil samples will be analyzed for parameters on the site target list for soils. These parameters will include those identified in the RA as being representative of the hazardous wastes or constituents handled in each SWMU [aromatic purgeables (benzene, toluene, ethylbenzene, xylenes) and base/neutral/acid semi-volatile organic fractions (BNAs including pyridine)], as well as any additional parameters based on the three expedited samples described in Section 4.3.2.

Laboratory analyses will be done in accordance with new U.S. EPA SW-846 protocol and the procedures set forth in the QAPP.

4.2.2 *Ground Water Technical Approach*

Much information has been gathered in regard to the hydrogeology beneath the site as a result of the RA and an investigation that was performed in conjunction with the RA, an Expanded Hydrogeological Investigation. The report summarizing the findings and results of the Expanded Hydrogeological Investigation is included with the RA report as Attachment I.

In summary, there are two independent water bearing strata beneath the site; a thin shallow water table unit and a deeper confined sand unit, separated from one another by a clay layer. The direction of ground water flow is generally toward the south, discharging to the Detroit and Rouge Rivers.

Water quality data which resulted from the RA have shown only nuisance levels of a few VOCs and SVOCs in the vicinity and immediately downgradient of SWMUs 1, 2, and 20 which are generally located downgradient from the majority of the site as a whole. These data therefore suggest that a significant ground water impact problem is not present downgradient of the site. This conclusion will be tested further during the RFI.

In general, the corrective measures that are most likely for this site will involve a mechanism to control the discharge of ground water from the site to the two adjacent rivers if **ground water is found to be impacted above Part 201 generic or site-specific industrial cleanup criteria**. It is also likely that these controls will be necessary only in the shallower of the two saturated zones since it is unlikely that ground water quality in the deeper of the two saturated zones will be impacted given the intervening low permeability clay layer.

U.S. EPA has expressed interest in the possibility of hydraulic communication between the two saturated zones and has gone so far as to suggest an aquifer test should be performed to determine the degree and extent of communication between the two units.

An aquifer test would be an appropriate mechanism for making such a determination; however, it has not been shown that a determination such as this is necessary to characterize the fate of contaminants at the site. Based upon the analytical results of ground water samples collected from the perimeter monitoring network in the shallow water table aquifer unit, and samples collected from the two wells adjacent to the Tar Tank Area SWMUs, an assessment of the need to perform an aquifer test will be made.

In the event chemical constituents are encountered in groundwater samples from the shallow water table unit at levels above Part 201 generic or site specific industrial cleanup criteria, the need for monitoring wells in the deeper sand unit and aquifer testing will be reviewed with the U.S. EPA RFI Project

Coordinator. If deemed necessary, an addendum to the RFI work plan will be prepared to address this issue and to obtain U.S. EPA approval of an aquifer test work plan.

Field Measurements

The pH, temperature, conductivity, **dissolved oxygen, and turbidity** of ground water purged from all wells sampled during the RFI (new monitoring wells, temporary monitoring wells and 2-inch piezometers) will be measured and evaluated to demonstrate ground water stabilization prior to collection of samples for laboratory analysis.

Laboratory

All ground water samples will be analyzed for parameters on the site target list for ground water. These parameters will include those identified in the RA as being representative of the hazardous wastes or constituents handled in each SWMU [aromatic purgeables (benzene, toluene, ethylbenzene, xylenes) and base/neutral/acid semi-volatile organic fractions (BNAs including pyridine)], as well as any **additional parameters based on the three expedited samples described in Section 4.3.2.**

Laboratory analyses will be done in accordance with U.S. EPA SW-846 protocol and the procedures set forth in the QAPP.

4.3 FIELD INVESTIGATION

4.3.1 SWMU-Specific Sampling and Analysis

4.3.1.1 SWMU 1 - Oil Pump Spray Storage Area

Description: Oil stored in this unit was sprayed onto the coal prior to its placement in the ovens. This unit originally consisted of an oil UST having a storage capacity of 10,000 gallons. The UST is still present although it was emptied and filled with sand prior to abandonment. A concrete secondary containment structure was constructed over the abandoned UST for containment of a 5,000 gallon above ground oil storage tank. The tank contained oil and diesel fuel. The above ground oil storage tank and concrete containment unit are no longer present at the site.

Previous Release Assessment Sampling and Analysis: Soil samples were submitted to the laboratory from the 5 to 6 foot, and 2 to 3 foot intervals in borings B1-1 and B1-2, respectively. Benzo(a)pyrene in the 2 to 3 foot sample

from boring B1-2 exceeded the residential direct contact criterion, but did not exceed its respective background value established for the site.

Based on the observation of obvious contamination (strong diesel odor and sheen) in boring B1-2 on the west side of the unit, monitoring well MW-2-95 was installed on the downgradient (grid south) side of the SWMU. Laboratory analysis of ground water from this well showed a very slight exceedance of the MDNR generic industrial drinking water criterion for benzene. All other compounds analyzed were below the analytical method detection limits.

Recommended Sampling During the RFI: The new shallow monitoring well adjacent to the Detroit River, along with existing piezometer P-4S, will test for the presence of contamination from SWMU 1 at the downgradient property boundary. The ground water sample collected from this well will be analyzed for parameters on the site target list for ground water to include: aromatic purgeables (benzene, toluene, ethylbenzene, xylenes) and base/neutral/acid semi-volatile organic fractions (BNAs including pyridine). As discussed previously, the need for monitoring wells in the deeper aquifer unit will be determined at the conclusion of the perimeter monitoring event.

4.3.1.2 SWMU 2 - Coal Fines Recovery Area

Description: This unit consisted of two 15 x 40 feet concrete settling basins which were approximately 16-18 feet deep. The basins were used to recover coal from process water generated from the coal pre-heat unit. Rainwater, residual coal fines and residual coal tar were removed from the unit in 1992. The concrete basins were "shoveled clean" and filled with approximately 500 cubic yards of clay.

Previous Release Assessment Sampling and Analysis: Soils were submitted for analysis from three of the seven borings drilled at SWMU 2. These were located on the west end, and the south side of the unit.

Benzo(a)pyrene occurred at concentration in excess of the residential direct contact criterion in borings B2-5, B2-6 and B2-7. Benzo(a)anthracene exceeded similar criterion in boring B2-5, and benzo(b&k)fluoranthene exceed that criterion in borings B2-5 and B2-6.

Using the established background values for the site instead of the residential direct contact value, however, the only exceedances were for benzo(a)pyrene, benzo(a)anthracene, and benzo(b&k)fluoranthene in boring B2-5 on the south side of the SWMU.

Monitoring well MW-1-95 was installed on the west end of the south side of SWMU 2 based on the presence of odoriferous shallow ground water encountered during the drilling of soil borings within the unit. Laboratory analysis of the ground water from this well showed detectable amounts of acenaphthene, naphthalene, and benzene. Of these three detectable compounds, only benzene exceeded the established health-based criterion for residential drinking water. The remainder of the compounds analyzed were below the detectable limits for the analytical methods used.

Recommended Sampling During the RFI: The new shallow monitoring well adjacent to the Detroit river will test for the presence of contamination from SWMU 2 at the property boundary. The ground water sample collected from this well will be analyzed for parameters on the site target list for ground water to include: aromatic purgeables (benzene, toluene, ethylbenzene, xylenes) and base/neutral/acid semi-volatile organic fractions (BNAs including pyridine). The need for monitoring wells in the deeper aquifer unit will be determined at the conclusion of the perimeter monitoring event.

4.3.1.3 SWMU 18 - Flare Stack

Description: This unit consisted of a stack which was used to flare excess coke oven gas. The stack was constructed of welded steel. Detroit Coke demolished the flare stack and associated piping.

Previous Release Assessment Sampling and Analysis: Soil samples were submitted for analysis from the 2 to 3 foot interval in two of the four borings drilled at this SWMU. Of the two samples submitted, the only exceedance under the residential direct contact criterion was for benzo(a)pyrene. None of the samples analyzed exhibited values in excess of the established site specific background values.

This SWMU was dropped from the Corrective Action process as a result of the RA findings.

4.3.1.4 SWMU 20 - Oil Storage Building

Description: This unit consisted of a 40 x 60 foot 8-inch curbed concrete pad. Blind sumps which extended to a depth of about 5 feet were located in each corner of the pad to collect spills. The unit was used to store virgin oils prior to their use in the coking process. Detroit Coke Corporation demolished and removed the concrete pad, and capped the area with approximately 12 inches of clay.

Previous Release Assessment Sampling and Analysis: Soil samples from all five soil borings drilled at SWMU 20 were submitted to the laboratory for analysis. Slight to moderate exceedances of the residential direct contact criteria for benzo(a)pyrene and benzo(b&k)fluoroanthene were observed in boring B20-5 on the west-central side of the unit, and in boring B20-3 in the southeast corner of the unit. However, the detected concentrations were below the established site specific background values for those compounds.

Monitoring well MW-3-95 was installed on the south (downgradient) side of SWMU 20 based on the presence of shallow ground water encountered during the drilling of soil borings within the unit. Although detectable amounts of fluorene, naphthalene, phenanthrene, pyrene, benzene, toluene, and total xylenes were noted as a result of laboratory analysis of the ground water from the well, only benzene was found in excess of the health-based residential drinking water standard.

Recommended Sampling During the RFI: The new shallow monitoring well adjacent to the River Rouge, along with existing piezometer P-4S, will test for the presence of contamination from SWMU 20 at the downgradient property boundary. The ground water sample collected from this well will be analyzed for parameters on the site target list for ground water to include: aromatic purgeables (benzene, toluene, ethylbenzene, xylenes) and base/neutral/acid semi-volatile organic fractions (BNAs including pyridine). **The need for monitoring wells in the deeper aquifer unit will be determined at the conclusion of the perimeter monitoring event.**

4.3.1.5 SWMU 15 - Fuel Oil Tank

Description: SWMU 15 consisted of a 2,000 gallon horizontal welded steel tank used to store diesel fuel. The diesel fuel was used to fuel equipment during operation of the facility. This SWMU also included a secondary containment unit consisting of a 5 foot high concrete wall.

Recommended Sampling During the RFI: To evaluate the potential for impact to surface soils due to overflow or leakage of the secondary containment and general operations, surface soil samples will be collected from the 0 to 2-foot depth interval at 4 locations corresponding to the outer perimeter of the secondary containment and at 1 location within the secondary containment area (the containment and tank structure have been demolished and removed). The proposed surface soil sampling locations are shown on Figure 4-2.

The surface soils will be analyzed for parameters on the site target list for soils to include: aromatic purgeables (benzene, toluene, ethylbenzene, xylenes) and base/neutral/acid semi-volatile organic fractions (BNAs including pyridine).

The new shallow monitoring well adjacent to the Detroit River will be used to evaluate the potential for impact to ground water downgradient of SWMU 15. The need for a monitoring well in closer proximity to SWMU 15 will be determined at the conclusion of the perimeter monitoring event.

4.3.1.6 Tar Tank Storage Area SWMUs (SWMUs 11, 12, and 13)

Description: The Tar Tank Area SWMUs includes SWMU 11 (Tar Tanks #10, #12, #13, and their secondary containment) SWMU 12; (The Trench Area) and SWMU 13; (Tar Pump House).

Recommended Sampling During the RFI: An evaluation of the impact to soils from the Tar Tank Area SWMUs will be made following the interim measures of removing residual tar and the above ground tanks and piping as presented in Section 2.3 - Brownfields Redevelopment of the Site.

Once the tanks, piping, and residual tar are removed from the Tar Tank Area SWMUs, soil samples will be collected immediately below the excavated depth at 24 locations corresponding to the outer perimeter of the secondary containment and at 11 locations within the secondary containment area (the containment, tank and other structures will be demolished and removed). The proposed soil sampling locations are shown on Figure 4-2.

The soil samples showing greatest evidence of impact, based on field screening results (25% of the total with the most potentially impacted being selected), will be analyzed. Samples will be analyzed for parameters on the site target list for soils to include: aromatic purgeables (benzene, toluene, ethylbenzene, xylenes) and base/neutral/acid semi-volatile organic fractions (BNAs including pyridine), as well as any additional parameters based on the three expedited samples described in Section 4.3.2.

The potential for impact to ground water downgradient of the Tar Tank Area SWMUs will be evaluated based on results from the perimeter monitoring well network described below. The new shallow monitoring well adjacent to the River Rouge and existing piezometer P-5S will test for the potential for ground water contamination at the property boundary. In addition, one upgradient and one downgradient well will be installed in the shallow water table aquifer unit around the Tar Tank Area SWMUs to evaluate the potential of this area as a source of the creosote-like material encountered in piezometer P-6D. The proposed monitoring well/piezometer sampling locations are shown on Figure 4-3.

Ground water samples collected from these locations will be analyzed for parameters on the site target list for ground water to include: aromatic

purgeables (benzene, toluene, ethylbenzene, xylenes) and base/neutral/acid semi-volatile organic fractions (BNAs including pyridine), as well as any additional parameters based on the three expedited samples described in Section 4.3.2.

4.3.1.7 By-Products Containment Area SWMUs (SWMUs 3, 5, 6, 19, and 21)

Description: The By-Products Containment Area SWMUs includes SWMU 3 (By-Products Area); SWMU 5 (Tanks 1 and 2 and their secondary containment); SWMU 6 (Tank 3 and its secondary containment); SWMU 19 (Round Dike) and SWMU 21 (Secondary Containment Area).

SWMU 3 consisted of a primary cooling tower tank, a secondary cooling tower tank, and an ammonia wash tower tank. These units were used to cool coke oven gas and remove ammonia. The cooling and wash towers were contained on a concrete pad with 12-inch curbing. Three electrostatic precipitators were also contained within the concrete pad.

SWMU 5 consisted of two 180,000 gallon welded steel tanks. The tanks were used to store weak ammonia liquor. The tanks were contained in a concrete pad with 5-foot high concrete walls.

SWMU 19 consisted of a round secondary containment structure which contained a tank. Details regarding the tank (e.g. construction, size, contents, etc.) are unknown. The secondary containment structure is constructed of concrete and approximately 30 feet in diameter and 12 feet deep.

SWMU 21 consisted of a secondary dike containment area. The secondary containment unit consisted of a concrete pad approximately 60x120 feet and concrete walls approximately 3 feet high. A metal building was located in one corner of the containment structure. The function of the containment structure is unknown.

Recommended Sampling During the RFI: To evaluate the potential for impact to surface soils due to overflow or leakage of the secondary containment and general operations, surface soil samples will be collected from the 0 to 2-foot depth interval at 17 locations corresponding to the outer perimeter of the secondary containment and at 5 locations within the secondary containment area (the containment and tank and other structures have been demolished and removed with the exception of the concrete pad beneath SWMU 3). The proposed surface soil sampling locations are shown on Figure 4-2.

The surface soil sample showing the greatest evidence of impact, based on field screening results (25% of the total with the most potentially impacted being

selected), will be analyzed. Samples selected will be analyzed for parameters on the site target list for soils to include: aromatic purgeables (benzene, toluene, ethylbenzene, xylenes) and base/neutral/acid semi-volatile organic fractions (BNAs including pyridine), **as well as any additional parameters based on the three expedited samples described in Section 4.3.2.**

The potential for impact to ground water downgradient of the By-Products Area SWMUs **will be evaluated at the property boundary through the perimeter monitoring network and the new well installed adjacent to the Detroit River.** The proposed monitoring well locations are shown on Figure 4-3.

Ground water samples collected from these wells will be analyzed for parameters on the site target list for ground water to include: aromatic purgeables (benzene, toluene, ethylbenzene, xylenes) and base/neutral/acid semi-volatile organic fractions (BNAs including pyridine), **as well as any additional parameters based on the three expedited samples described in Section 4.3.2.**

The need for a monitoring well in closer proximity to the By-Products Containment Area SWMUs will be determined at the conclusion of the perimeter monitoring event.

4.3.1.8 Site Perimeter Ground Water Investigation

Description: The site perimeter represents a significant point of compliance with regard to the ground water exposure pathway. Ground water quality at the upgradient perimeter will be established to facilitate a comparative evaluation of impacts (if any) to ground water due to SWMU operation. Ground water quality at the downgradient perimeter will be established to assess risk due to ground water impact (if any) near the point where ground water flow beneath the site discharges to the rivers.

Recommended Sampling During the RFI: Ground water quality at the site perimeter will be investigated through the sampling of **two new monitoring wells and seven existing wells/piezometers (P-4S, P-3S, P-2S, MW-5, P-6D, P-1S, and P-5S).** The proposed monitoring well locations and ground water sampling points are shown on Figure 4-3.

The perimeter ground water samples will be analyzed for parameters on the site target list for ground water to include: aromatic purgeables (benzene, toluene, ethylbenzene, xylenes) and base/neutral/acid semi-volatile organic fractions (BNAs including pyridine), **as well as any additional parameters based on the three expedited samples described in Section 4.3.2.**

4.3.2 *Background and Site Target List Sample Collection and Analysis*

The RA included work to establish site-specific background values that reflect baseline levels indicative of both native and anthropogenic components (primarily past industrial activities), of polynuclear aromatic compounds in soil and purgeable aromatics and BNAs including pyridine in ground water. These baseline background levels were established for comparison to the **on-site** data, which was collected in the vicinity of the **SWMUs for a specific target list of chemical constituents** to identify releases from the SWMUs.

These baseline background levels will be carried forward to the RFI for similar comparisons to determine if environmental media have been impacted. The baseline database may, however, require expansion to include additional constituents if analysis of representative impacted soil samples indicates that additional parameters should be added to the RA site target parameter lists for soil and ground water. In particular, background concentrations for metals in soil, and possibly ground water, may be needed.

4.3.2.1 *Soil*

To determine if the site target list needs to be modified for soils, one background location (BG-04) will be re-sampled and the soil analyzed for Volatile Organic Compounds (VOCs) and the "Michigan 10" metals. Similarly, two soil samples, one each from the Tar Tank Area SWMUs and the By-Products Containment Area SWMUs which have the greatest potential for impact based on field screening, will be analyzed for SVOCs, VOCs and the "Michigan 10" metals. If any of the resulting analyses exceed the generic industrial cleanup criteria under Part 201 - Environmental Remediation of Act 451, they will be added to the site target list.

If additional parameters are added to the site target list, soil samples will be collected and analyzed in accordance with MDEQ guidance to establish site-specific background for any additional constituents of concern, particularly metals, in soil. To ensure a sufficient representative data population, the eight previously sampled background locations (**which includes BG-04**) will be used. The locations, depicted on Figure 4-2, were selected during a U.S. EPA visit and did not evidence significant surficial contamination from coal fines. These locations may be altered slightly, based on field discretion, if more representative locations are apparent.

The previous sample depth interval of 0 to 2 feet has been selected to be representative of the same soil horizon being sampled at the SWMUs. The background data set will be evaluated for statistical outliers prior to the establishment of the site-specific background value (as specified in the MDNR's

Guidance Document for Verification of Soil Remediation, April 1994; Appendix A). If a data point is identified as a statistical outlier, it will not be used in the development of a site-specific background value. The upper limit background value will be determined statistically as the mean plus three standard deviations, based upon the laboratory analytical results for these samples.

4.3.2.2 Ground Water

Additional background ground water quality data will be collected to supplement the existing database and to establish upgradient conditions for any additional constituents if analysis of representative impacted soil samples indicate that additional parameters should be added to the RA site target parameter list for ground water.

Background ground water quality will be determined through sampling of the two existing upgradient temporary monitoring wells, MW-4 and MW-5. **Well MW-4 will be sampled once during the first round of the perimeter network sampling event. Well MW-5 will be sampled quarterly as part of the perimeter monitoring network.** The site ground water quality will be compared to the background values to determine whether detected compounds are evidence of impact relative to **Part 201 - Environmental Remediation of Act 451 general or site-specific industrial cleanup criteria** or are representative of background conditions.

Ground water samples from these two wells will be analyzed for the comprehensive list of indicator parameters which consists of purgeable aromatics and BNAs including pyridine and any other significant parameters identified in the soil re-sample from location BG-04 **and the two on-site samples.**

4.3.3 Site Maps of Sampling Locations

Figures 4-2 and 4-3 show the intended soil and ground water sampling locations. It is possible, however, that depending on the nature of field conditions encountered, some of these locations will be changed. The person who shall be responsible for making such decisions will be the **ERM RFI Coordinator** whose responsibilities are described in Section 4.1.

4.3.4 Rationale of Selected Sample Locations

The RFI will focus primarily on a perimeter ground water investigation with SWMU specific ground water quality investigation limited to that necessary to support a risk assessment and design appropriate exposure controls for this media. The RFI will also focus on defining potential direct human contact exposures to soil. The concentration of chemicals of concern in the surface soil

(defined as 0-2 feet) at the SWMUs will be investigated to determine the potential for completion of current and future soil exposure pathways for on-site populations.

Factors that have been considered in the selection of the sampling points and media for the RFI are as follows:

- the likely mechanism of release;
- the characteristics of the materials managed in the unit (mobility, volatility, miscibility, solubility, and other relevant characteristics); and
- characteristics of the site that affect contaminant fate and transport (topography, lithology, stratigraphy, hydrogeology, etc.).

Given the long industrial history of the site and the region in which it is located, the technical approach for this RFI has also taken into account a fourth factor: characteristics of the site and region that have a significant potential for causing analytical interference during the course of the RFI. Such characteristics include: current and historical uses of the site and adjacent properties, the prevalence of fill materials in the area, proximity to large air emission sources, etc.

The sampling and analysis strategy for the RFI has been designed to identify the existence of constituents of concern in environmental media (due to past releases from the SWMUs) at the endpoints of relevant exposure pathways. The relevance of the exposure pathways is based on consideration of the four factors above and upon a generalized plan for future site use (Current Conditions Report).

4.3.5 *Sample Network Summary Table*

The sample network for this project is presented in tabular format on Table 1-1 of the QAPP.

4.4 *SAMPLE ANALYSIS AND VALIDATION*

The sample analysis and validation procedures are discussed in Section 7.0 and 9.2 of the QAPP.

4.5 *INVESTIGATION ANALYSIS*

All site investigation data will be evaluated and presented in an organized and logical manner so that the relationships between site investigation results for

each medium are apparent. A summary will be prepared that describes the quantities and concentrations of specific contaminants at the site and the background levels surrounding the site.

4.6 REPORTS

4.6.1. Progress Reports

Quarterly progress reports will be submitted to the U.S. EPA following the initiation of field sampling activities and through submittal of a draft final report summarizing RFI activities and findings. These reports will include the following:

- A description and estimate of the percentage of the RFI completed;
- Summaries of all findings;
- Summaries of all changes made in the RFI during the reporting period;
- Summaries of all contacts with representative of local community public interest groups or State government during the reporting period;
- Summaries of all problems or potential problems encountered during the reporting period;
- Actions being taken to rectify problems;
- Changes in personnel during the reporting period;
- Projected work for the next reporting period; and
- Copies of daily reports, inspection reports, laboratory/monitoring data, etc.

4.6.2 Draft and Final RFI Reports

The RFI Report will be developed in draft form for Detroit Coke review. The RFI Report will be developed in final format addressing comments received by Detroit Coke on the Draft RFI Report and forwarded to U.S. EPA for approval.

Two copies of the reports will be provided to the U.S. EPA.

4.7 *SCHEDULE*

The attached Figure 4-4 provides the anticipated time-line for completion of the RFI. The time-line has been prepared under consideration of the schedule stipulated in the UIC permit for the Detroit Coke facility.

TABLE 3-1
SUMMARY OF TECHNOLOGIES POTENTIALLY APPLICABLE TO
SOILS IMPACTED BY VOCS
Detroit Coke Corporation
Detroit, Michigan

General Response Action	Remedial Technology	Process Option
No Action	None	None
Institutional Action	Access Restriction	Deed Restrictions Site Fencing
Surface Water Diversion	Surface Controls	Grading Soil Cover/Revegetation
Containment	Capping (single layer)	Synthetic Membrane Clay Asphalt/Concrete
	Capping (multiple layer)	Multimedia
Removal	Excavation	None
On-Site Treatment	Incineration	Rotary Kiln Fluidized Bed Infrared
	Above-Ground Treatment	Aeration Slurry Degradation Thermal Desorption Critical Fluid Extraction
	<i>In Situ</i> Treatment	Microbial Degradation Oxidation Fixation/Solification Soil Flushing Soil Aeration Soil Vapor Extraction Vitrification
Off-Site Treatment	RCRA Incineration	None
On-Site Disposal	RCRA Landfill	None
	Type II Landfill	None
Off-Site Disposal	RCRA Landfill	None
	Type II Landfill	None

TABLE 3-2
SUMMARY OF TECHNOLOGIES POTENTIALLY APPLICABLE TO
SOILS IMPACTED BY SVOCs
Detroit Coke Corporation
Detroit, Michigan

General Response Action	Remedial Technology	Process Option
No Action	None	None
Institutional Action	Access Restriction	Deed Restrictions Site Fencing
Surface Water Diversion	Surface Controls	Grading Soil Cover/Revegetation
Containment	Capping (single layer)	Synthetic Membrane Clay Asphalt Concrete
	Capping (multiple layer)	Multimedia
Removal	Excavation	None
On-Site Treatment	Incineration	Rotary Kiln Fluidized Bed Infrared
	Above-Ground Treatment	Thermal Desorption Critical Fluid Extraction
	<i>In Situ</i> Treatment	Vitrification Soil Flushing Fixation/Solidification
Off-Site Treatment	RCRA Incineration	None
On-Site Disposal	RCRA Landfill	None
	Type II Landfill	None
Off-Site Disposal	RCRA Landfill	None
	Type II Landfill	None

TABLE 3-3
SUMMARY OF TECHNOLOGIES POTENTIALLY APPLICABLE TO
GROUND WATER IMPACTED WITH VOCS
Detroit Coke Corporation
Detroit, Michigan

General Response Action	Remedial Technology	Process Option
No Action	None	None
Institutional Action	Access Restriction	Deed Restrictions Site Fencing
	Alternate Water Supply	City Water Supply
	Monitoring	Ground Water Monitoring
Surface Water Diversion	Surface Controls	Grading/Revegetation
Containment	Capping (single barrier)	Synthetic Membrane Clay Asphalt Concrete
	Capping (multiple layer)	Multimedia
	Vertical Barriers	Slurry Wall Grout Curtain Metallic Sheet Piling Concrete Wall
	Gradient Controls	Barrier Wells Interceptor Trench Sumps
Collection	Extraction	Extraction Wells
	Passive Collection	Interceptor Trenches Sumps
On-Site Treatment	Biological Treatment	Activated Sludge Trickling Filters Rotating Biological Contactors Submerged Fixed Film Reactors
	Biophysical Treatment	PACT Treatment Activated Carbon Adsorption Fluidized Bed
	Chemical Treatment	Oxidation Ultraviolet Enhanced Oxidation Neutralization Precipitation Reduction

TABLE 3-3
SUMMARY OF TECHNOLOGIES POTENTIALLY APPLICABLE TO
GROUND WATER IMPACTED WITH VOCS
Detroit Coke Corporation
Detroit, Michigan

General Response Action	Remedial Technology	Process Option
	Physical Treatment	Air Stripping Ion Exchange Reverse Osmosis Dissolved Air Flotation
	<i>In Situ</i> Treatment	Microbial Degradation Air Sparging Biosparging
Effluent Disposal	Publicly Owned Treatment Works (POTW)	None
	Direct Discharge to Surface Water	None
Off-Site Treatment	POTW	None
	RCRA Facility	None
On-Site Disposal	Deep Well Injection	None

TABLE 3-4
SUMMARY OF TECHNOLOGIES POTENTIALLY APPLICABLE TO
GROUND WATER IMPACTED WITH SVOCs
Detroit Coke Corporation
Detroit, Michigan

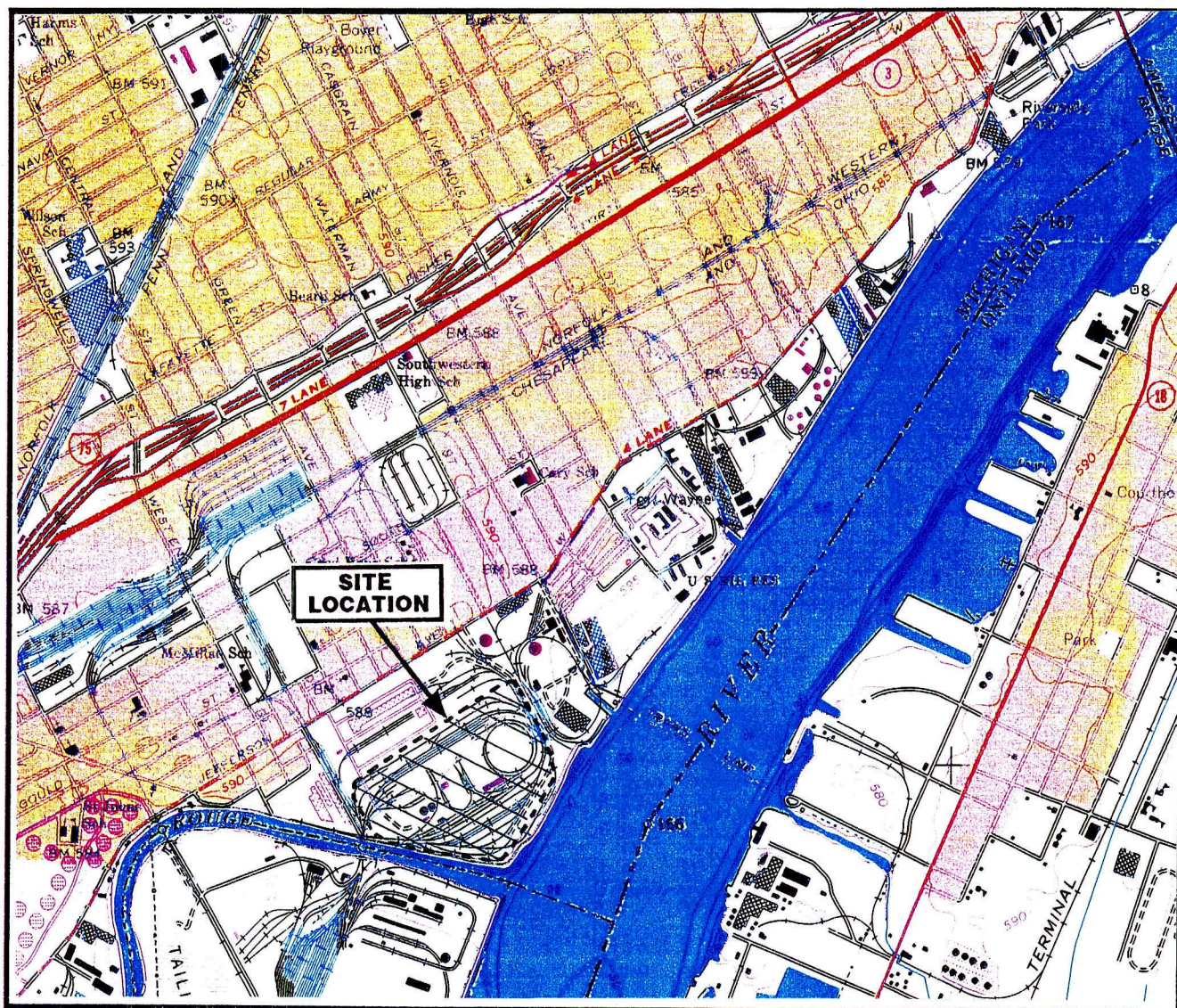
General Response Action	Remedial Technology	Process Option
No Action	None	None
Institutional Action	Access Restriction	Deed Restrictions Site Fencing
	Alternate Water Supply	City Water Supply
	Monitoring	Ground Water Monitoring
Surface Water Diversion	Surface Controls	Grading/Revegetation
Containment	Capping (single barrier)	Synthetic Membrane Clay Asphalt Concrete
	Capping (multiple layer)	Multimedia
	Vertical Barriers	Slurry Wall Grout Curtain Metallic Sheet Piling Concrete Wall
	Gradient Controls	Barrier Wells Interceptor Trench Sumps
Collection	Extraction	Extraction Wells
	Passive Collection	Interceptor Trenches Sumps
On-Site Treatment	Biological Treatment	Activated Sludge Trickling Filters Rotating Biological Contactors Submerged Fixed Film Reactors
	Biophysical Treatment	PACT Treatment Activated Carbon Adsorption Fluidized Bed
	Chemical Treatment	Oxidation Ultraviolet Enhanced Oxidation Neutralization Precipitation Reduction

TABLE 3-4
SUMMARY OF TECHNOLOGIES POTENTIALLY APPLICABLE TO
GROUND WATER IMPACTED WITH SVOCs
Detroit Coke Corporation
Detroit, Michigan

General Response Action	Remedial Technology	Process Option
	Physical Treatment	Carbon Adsorption Extraction Reverse Osmosis Steam Stripping
	<i>In Situ</i> Treatment	Microbial Degradation
Effluent Disposal	Publicly Owned Treatment Works (POTW)	None
	Direct Discharge to Surface Water	None
Off-Site Treatment	POTW	None
	RCRA Facility	None
On-Site Disposal	Deep Well Injection	None

TABLE 3-5
SUMMARY OF TECHNOLOGIES POTENTIALLY APPLICABLE TO FREE PRODUCT
Detroit Coke Corporation
Detroit, Michigan

General Response Action	Remedial Technology	Process Option
No Action	None	None
Institutional Action	Access Restriction	Deed Restrictions Site Fencing
Surface Water Diversion	Surface Controls	Grading Soil Cover/Revegetation
Containment	Capping (single layer)	Synthetic Membrane Clay Asphalt Concrete
	Capping (multiple layer)	Multimedia
Recovery	Passive Extraction	Interceptor Trench Sumps Passive Recovery Wells
	Active Extraction	Active Recovery Wells Skimming Systems
	On-Site Treatment	Oil/Water Separation Coalescing Separation
	Off-Site Disposal	RCRA Facility



HORIZON ENVIRONMENTAL

DETROIT COKE CORPORATION
DETROIT, MICHIGAN

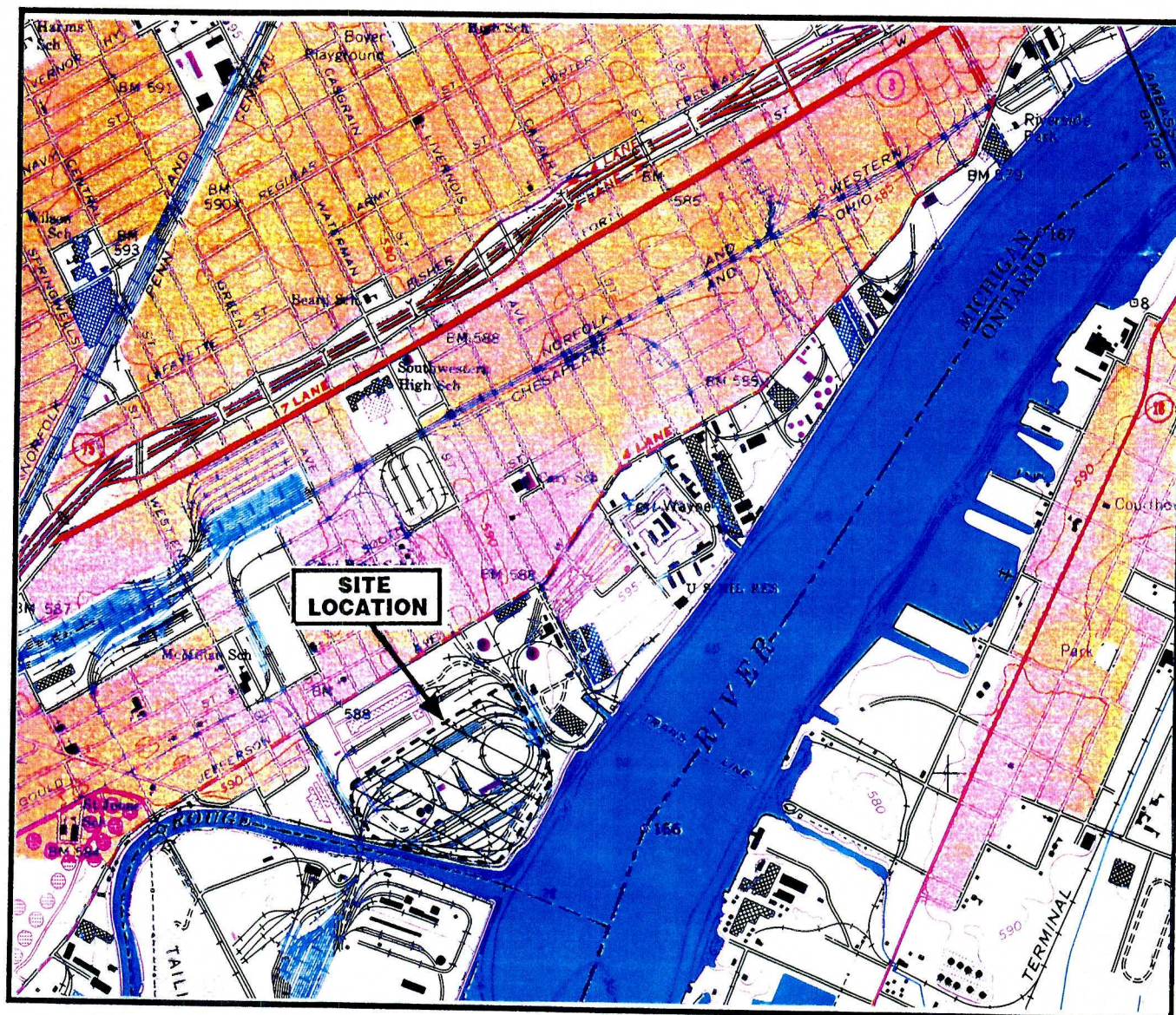
SITE LOCATION MAP

PROJECT NUMBER:
DET-0101

FIGURE:

1-1

DECEMBER, 1994



HORIZON ENVIRONMENTAL

DETROIT COKE CORPORATION
DETROIT, MICHIGAN

SITE LOCATION MAP

PROJECT NUMBER:
DCC-0101

FIGURE:
2-1

SEPTEMBER, 1995

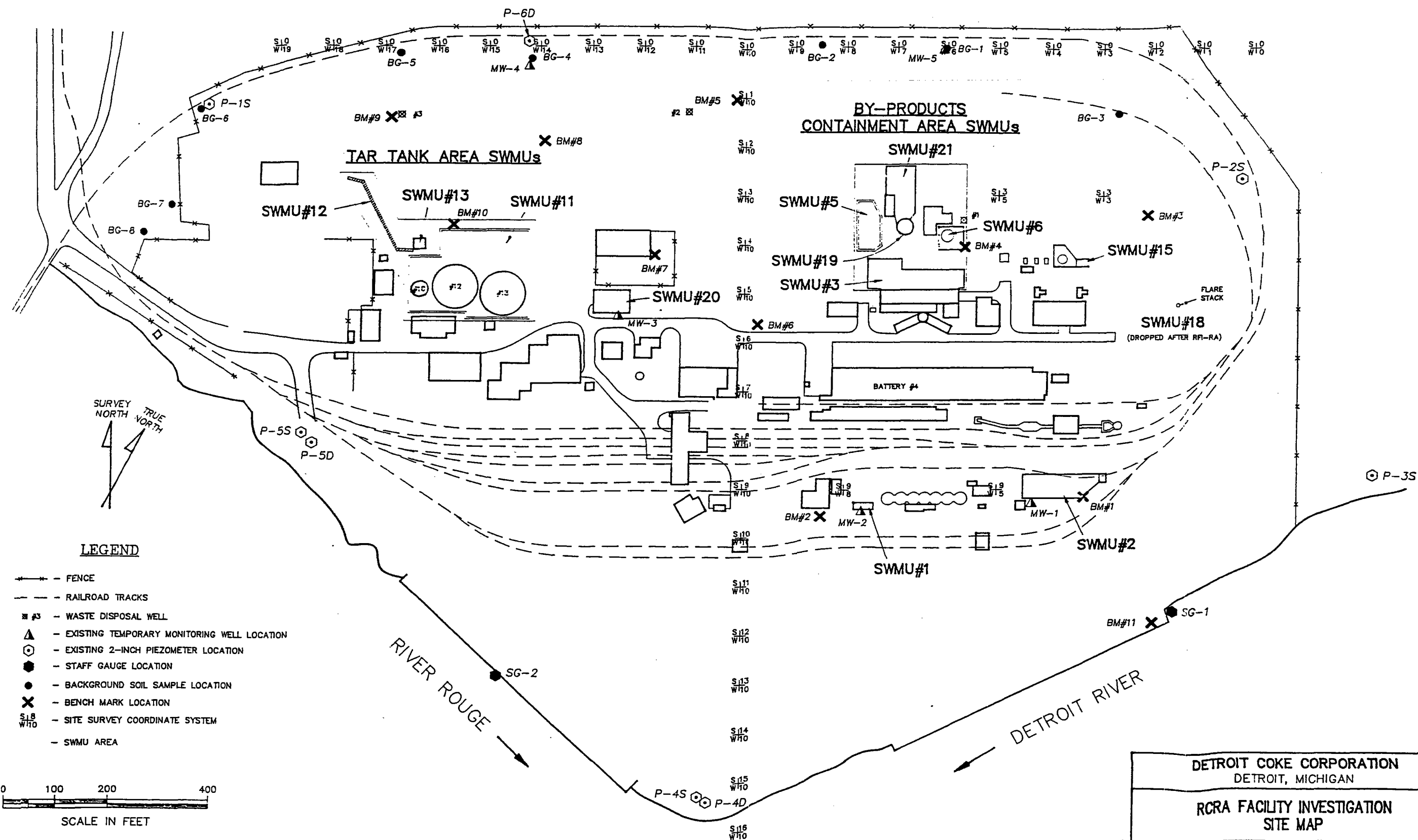
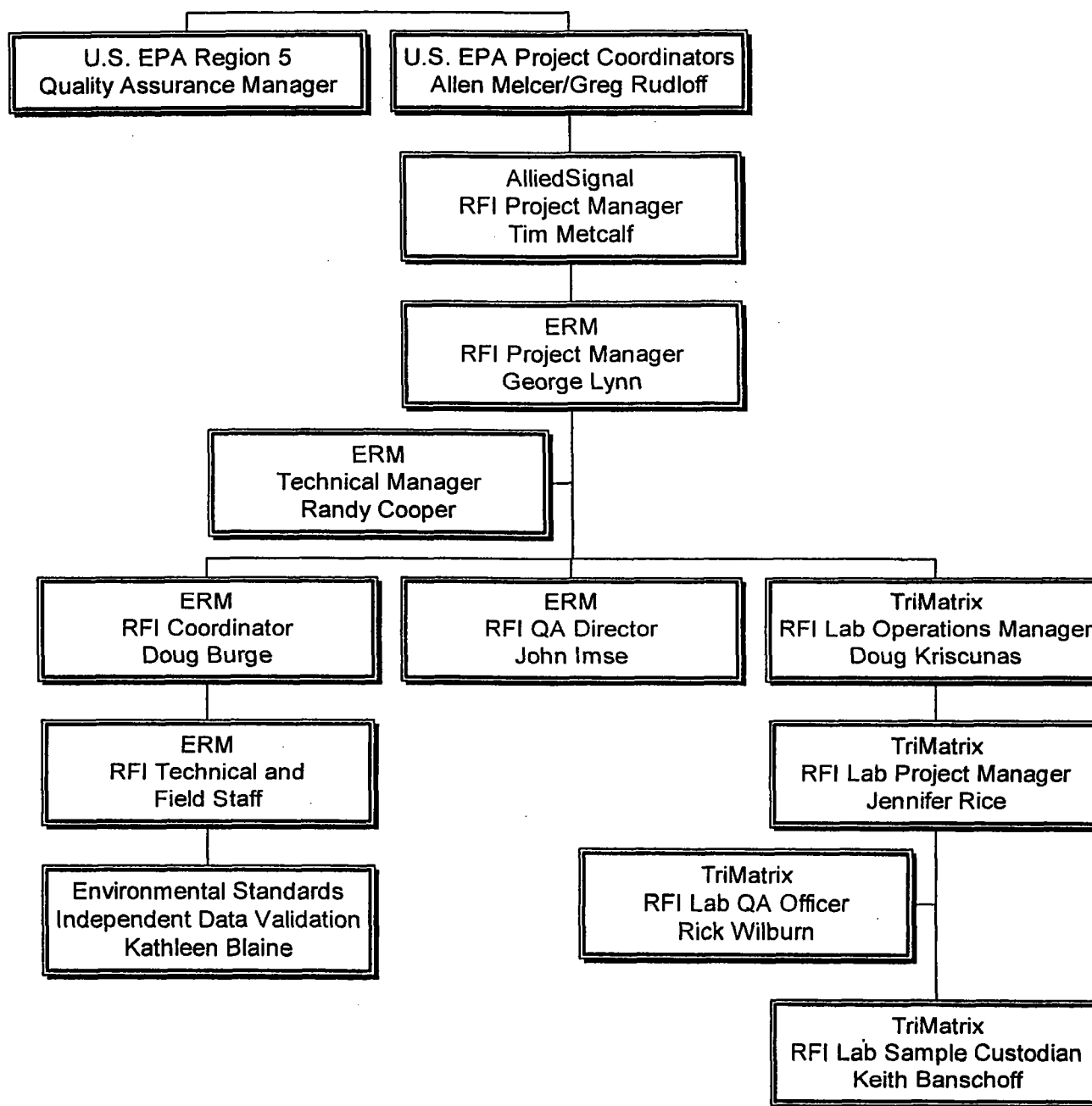
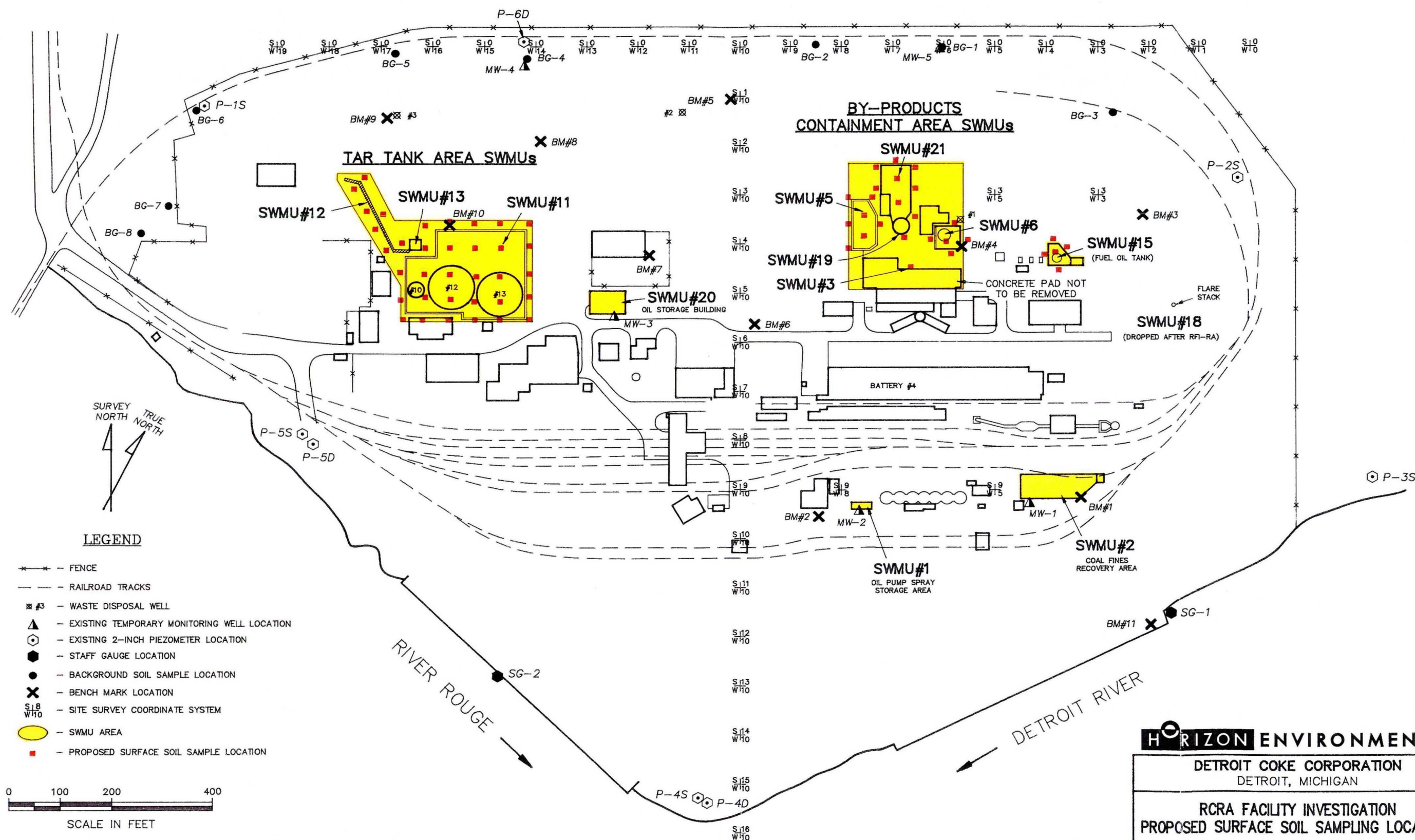
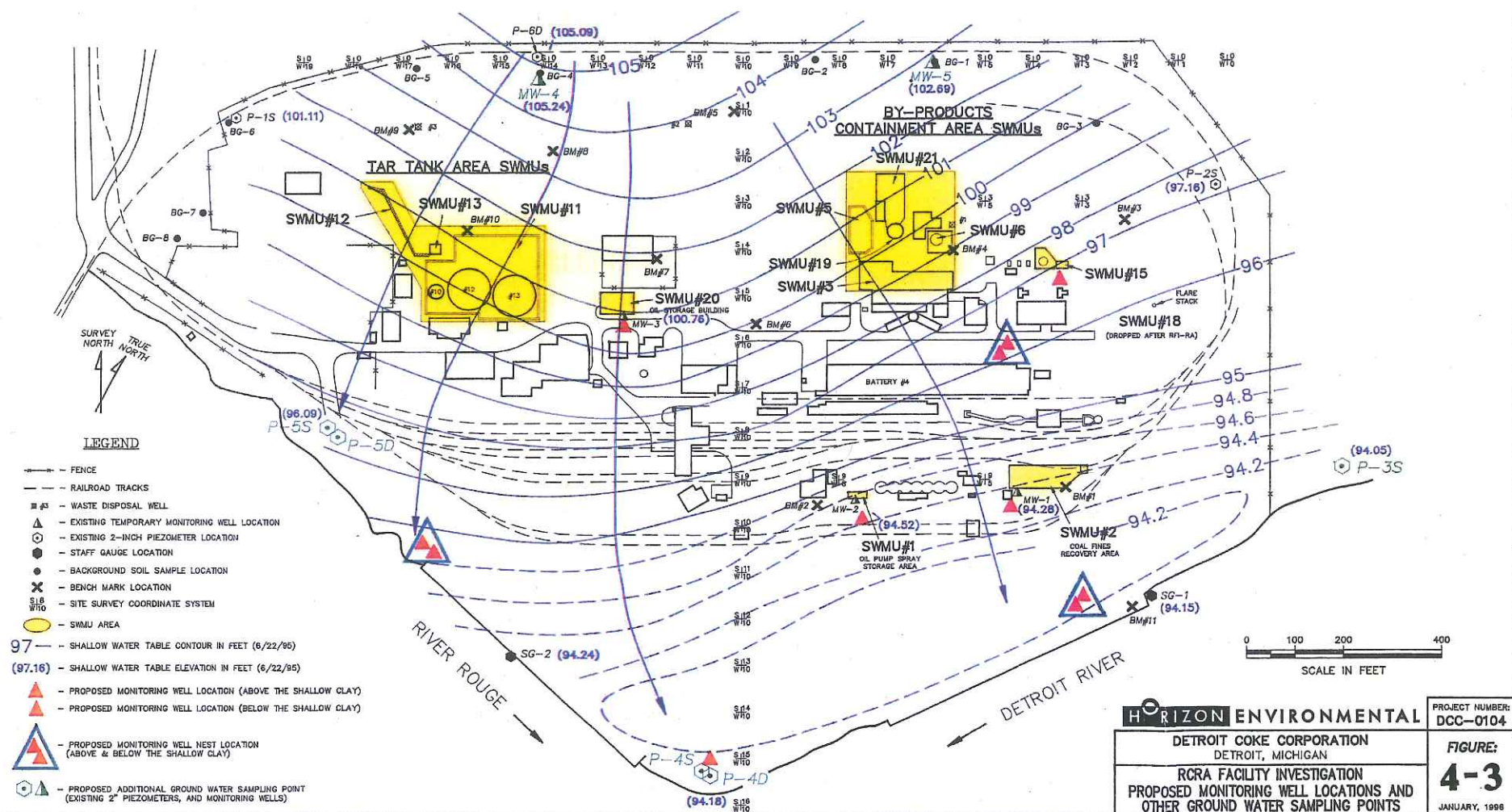
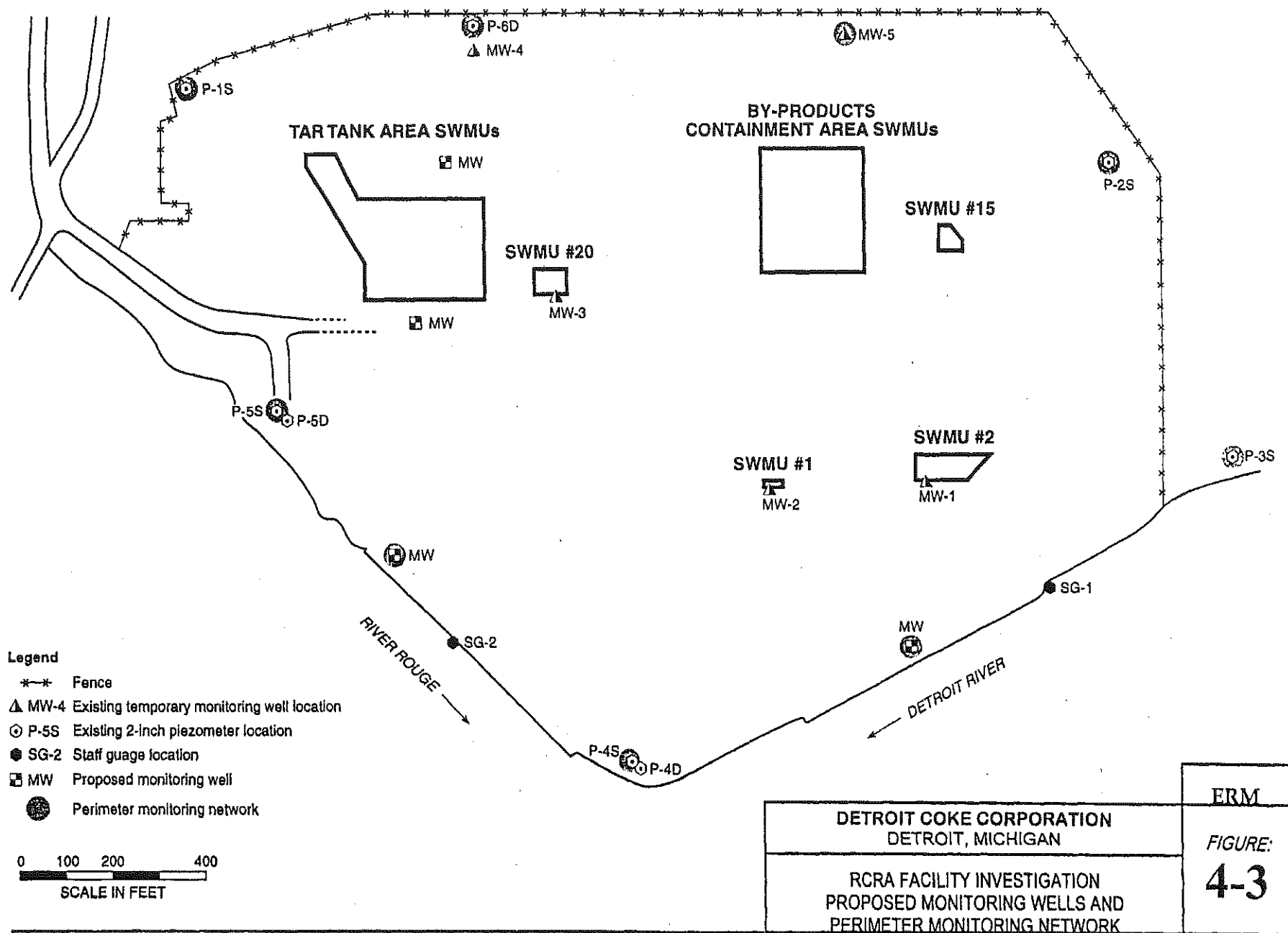


FIGURE 4-1
QUALITY ASSURANCE AND MANAGEMENT RESPONSIBILITIES
DETROIT COKE FACILITY RFI









**Figure 4-4
PROJECT SCHEDULE
DETROIT COKE FACILITY RFI**

TASK DESCRIPTION	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16
1. Equipment Preparation and Mobilization	■															
2. Tar Tank Cleanout		■	■	■												
3. Tank and Piping Removal			■	■	■	■										
4. Tar Removal from Tar Tank Area SWMUs				■	■	■	■	■								
5. Field Investigation					■	■	■	■	■							
a) Monitoring Well Installation					■	■	■	■	■							
b) Groundwater Sampling						■	■	■								
c) Outfall Sampling							■	■								
b) Soil Sampling							■	■	■							
c) Laboratory Analysis						■	■	■	■	■	■	■	■			
6. Independent Data Validation									■	■	■	■	■	■		
7. Data Evaluation and Preparation of Draft RFI Report									■	■	■	■	■	■	■	
8. AlliedSignal Review of Draft RFI Report														■	■	■
9. Preparation of Final RFI Report																■
10. Submittal of Final Report to U.S. EPA																

1. Schedule assumes one month for tank/piping and tar removal subcontractor selection prior to project startup.

APPENDIX A
MDNR GUIDANCE DOCUMENT FOR
VERIFICATION OF SOIL REMEDIATION

GUIDANCE DOCUMENT
VERIFICATION OF SOIL REMEDIATION



ENVIRONMENTAL RESPONSE DIVISION
WASTE MANAGEMENT DIVISION

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Michigan Department of Natural Resources

APRIL 1994, Revision D

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MICHIGAN DEPARTMENT OF NATURAL RESOURCES

GUIDANCE DOCUMENT FOR VERIFICATION OF SOIL REMEDIATION

EXECUTIVE SUMMARY

The document provides guidance for sampling soils to verify that soil contamination has been remediated to Type A or Type B criteria in accordance with Act 307 P.A. 1982, as amended. This document is not designed to either guide investigations to determine whether a release has occurred or the nature and extent of an identified release, nor to guide due diligence by a potential property owner. Issuance of this guidance document does not invalidate remedial action plans (RAPS) or clean-ups previously conducted and approved by the DNR.

Soil sampling and analyses to verify that site remediation is complete can result in two basic errors.

- ◆ Declaring a site clean when it is contaminated
- ◆ Declaring a site contaminated when it is clean

A soil sampling plan submitted to the DNR must minimize these errors. The guidance document presents acceptable methods for verifying soil remediation. It contains guidance on soil sampling protocols and documentation necessary to characterize and verify cleanup of contaminated soils. The document provides recommended procedures for establishing soil background concentrations, sampling grids, chemical constituent evaluations, statistical comparisons, verifying excavation and in-situ and ex-situ remedies, evaluating treated soils, and soil characterization. The recommended procedures are not *absolute*. Other methods are available to verify soil remediation. The Department of Natural Resources will evaluate other sampling and statistical strategies on a case-by-case basis.

The guidance document is divided into two parts:

Part 1 contains guidance for small site cleanup verification (less than 10,890 square feet—<.25 acre). It is a "biased" sampling strategy recommending soil sampling from areas most likely to contain contamination.

Part 2 contains guidance for soil characterization and cleanup verification of medium and large sites (greater than 10,890 square feet—>.25 acre). It is a statistical random sampling strategy that minimizes biases in sampling.

Both sampling strategies require discrete soil samples. Compositing samples for cleanup verification is not accepted without prior DNR approval.

The guidance document contains verification checklists and reporting sections. The reporting sections should be carefully followed in reporting sampling rationale.

Reader's Note: Questions regarding this guidance document should be directed to Department staff you are currently working with for your project or site.

DNR—GUIDANCE DOCUMENT, PART 1

SMALL SITE SOIL CLEANUP VERIFICATION (LESS THAN 10,890 SQUARE FEET)

Part 1 of this document is a guide for a biased sampling strategy to verify that soil contamination has been remediated at sites no greater than 0.25 acres (small sites). Soil sampling and analyses to verify that a site remediation is complete can result in two basic errors.

- Declaring a site clean when it is contaminated
- Declaring a site contaminated when it is clean

A soil sampling plan submitted to the DNR must minimize these errors. Part 1 presents a biased sampling method of verifying soil remediation at small sites. The biased sampling approach specified in this guidance recommends soil sampling from areas most likely to still exceed cleanup criteria. The location of the soil sample points relies on a site specific analysis of the released or contaminant distribution and the soil types encountered. The remediation is verified using a point by point comparison of sample values with the appropriate cleanup criteria. If the cleanup criteria are exceeded at any sampled point, the biased sampling methodology may require additional remediation at that point until the criteria are met. Verification of cleanup utilizing the biased approach should generally require fewer samples to demonstrate attainment than by using the unbiased approach. DNR will evaluate other sampling and statistical strategies on a case-by-case basis.

Any biased sampling plan, whether presented in the guidance document or some other geostatistical approach, requires professional judgment. Therefore, documentation and the rationale used to select sample locations are extremely important. The report section (page 9) of this guidance document should be carefully followed.

Compositing samples for verifying soil remediation is not acceptable without prior DNR approval. When verifying a soil remediation is complete, contaminant concentrations will be low. Compositing may result in the contaminant concentrations not being representative of what remains in the soil. If concentrations are low, compositing may dilute the concentrations of a contaminant to below its threshold detection limit. Additionally, if contamination is indicated in a composited sample, the location of the contamination remains unknown.

Part 1 is divided into five main sections: Verifying Excavation Remedies, Verifying In-Situ and Ex-Situ Soil Remedies, Sample Analysis, Background Soil Samples, and Reports. The excavation and in-situ remediations require different strategies for verification. Guidance is presented for statistically determining background concentrations of compounds/contaminants. Guidance for reporting all appropriate information is presented to facilitate remediation approval.

VERIFYING EXCAVATION REMEDIES

Verifying that contaminated soil is remediated by means of excavation requires samples from the excavation bottom and sidewalls. Tables and formulas presented provide the minimum number of samples necessary to verify cleanup for various size excavations. The biased approach specified in this guidance recommends soil sampling from areas most likely to still exceed cleanup criteria. The location of the sample collection points relies on site specific analysis of the release or contaminant distribution and the soil types encountered in the excavation. The minimum number of excavation floor and sidewall samples required to demonstrate verification using a point by point comparison with the cleanup criteria are specified. If the cleanup criteria are exceeded at any point, this verification methodology may require additional excavation at that point until the criteria are attained.

Sampling and analyzing the locations most likely to have contaminants can minimize the number of samples needed to verify remediation is complete. Since professional judgment and site specific knowledge are required for selecting sampling locations, the rationale used to select these locations must be documented in the verification report.

SAMPLE LOCATIONS

Using a biased sampling approach, samples must be collected where they will most likely encounter contamination which could exceed the cleanup criteria. This will minimize the number of samples needed to verify a site is remediated. A sampling strategy that uses bias to choose sample locations is recommended. While it is inappropriate for this guidance document to dictate exact locations for sample collection in this strategy, site specific information (e.g., the location of leaks in an underground storage tank or its piping) from the remedial investigation concerning the release and soil conditions should be used along with professional judgment and the general guidance provided here to select appropriate soil sampling locations.

EXAMPLE: It would be incorrect to sample the north side of an excavation pit as extensively as the south side when the leak was confirmed on the south side of the tank.

Because a site must be remediated to a certain degree before approval can be considered, an analysis of data generated by a prior investigation should yield information for the verification analysis. The field personnel present during remediation should be sufficiently familiar with the conditions on-site to implement an appropriate verification strategy. A soil verification strategy should incorporate all pertinent biases of a site which may include, but are not limited to, those listed below.

- preferential pathways of contaminant migration
- source areas
- stained soils
- other site specific "clues" (e.g., fractures in clays)
- changes in soil characteristics (e.g., sand/clay interfaces)
- soil types and characteristics

NUMBER OF SAMPLES

The following tables are used to determine the minimum number of samples necessary from the floor and sidewalls of an excavation no greater than 0.25 acres using a biased sampling approach. If the area of the excavation floor exceeds 10,890 square feet, use Part 2 of this guidance document. A site may have an appropriate number of samples collected for verification, but, if the samples are not collected from the appropriate locations (discussed previously) and adequately reported, remediation may not be considered adequate. All sample locations must be accurately located, described, and reported. It should be noted that "excavation" as used here refers only to that area excavated for remediation purposes and being verified to meet Type A/Type B cleanup criteria.

Number of Excavation Floor Samples

Determine the minimum number of excavation floor samples from the table below.

TABLE 1

EXCAVATION FLOOR SAMPLES

<i>Area of Floor (sq ft)</i>	<i>Number of Samples</i>
< 500	2
500 < 1,000	3
1,000 < 1,500	4
1,500 < 2,500	5
2,500 < 4,000	6
4,000 < 6,000	7
6,000 < 8,500	8
8,500 < 10,890	9

Number of Excavation Sidewall Samples

Sidewall samples are required to verify that the horizontal extent of contamination has been remediated. Use Table 2 to determine the minimum number of required sidewall samples. In no case is less than one sample on each sidewall (i.e., four) acceptable. In the case of irregularly shaped excavations, where four walls are not readily discernible, divide the total wall area into four segments of approximately equal size. Sidewall samples should be located in accordance with "biases" outlined earlier in Part 1.

TABLE 2**EXCAVATION SIDEWALL SAMPLES**

<i>Total Area of Sidewalls (sq ft)</i>	<i>Number of Samples</i>
< 500	4
500 < 1,000	5
1,000 < 1,500	6
1,500 < 2,000	7
2,000 < 3,000	8
3,000 < 4,000	9
> 4,000	1 sample per 45 lineal feet of sidewall

VERIFYING IN-SITU AND EX-SITU SOIL REMEDIES

The effectiveness of in-situ soil remedies must be verified by three-dimensional random soil sampling. Refer to Attachment 2 for approved statistical sampling strategies. Certain ex-situ remedies, such as bio-piles or above-ground vapor extraction, may be amenable to statistical sampling strategies or batch sampling. Any proposed sampling strategy for in-situ or ex-situ remedies should be pre-approved by the DNR.

SAMPLE ANALYSIS

All test methods and associated target detection levels for cleanup verification must be consistent with those specified in MERA Operational Memorandum #6. Also, MERA Operational Memorandum #13 may be reviewed to evaluate appropriate QA/QC procedures. Generally, constituents in soil will be measured on a total, dry weight basis.

BACKGROUND SOIL SAMPLES

ESTABLISHING SOIL BACKGROUND

Establishing soil background, as required by Act 307 PA 1982, as amended, Michigan Environmental Response Act (MERA), can be accomplished by utilizing Operational Memorandum #15 or using the following guidance.

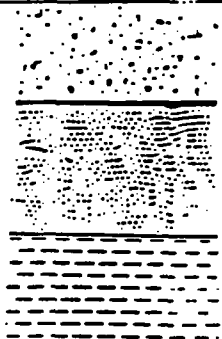
Background should be established as appropriate for site specific waste constituents, specific chemicals used in various processes, facility operations, or remedial investigation results. Sample analyses may include metals, organic constituents, or other site specific waste constituents. Analyses should be in accordance with MERA Operational Memorandum #6

Many factors can play a part in the background concentrations of a chemical in soil.

EXAMPLE: The geologic origin (e.g., the parent rock) of glacial drift may have been high in copper, lead, or other metals that may be potential contaminants. Additionally, the hydrogeologic situation can alter the quantity of these elements. Groundwater recharge areas (e.g., highlands) are frequently leached of metals while groundwater discharge areas (e.g., swamps, floodplain) are the recipients of leached metals. Thus, sites in low areas will usually have higher background concentrations than upland areas. Other conditions, such as precipitation and atmospheric fallout from widely dispersed human and natural activities, also affect soil concentrations.

A minimum of four samples must be used to establish "background" in soils. This will help account for natural constituent occurrences and inherent variability within each distinctive soil horizon. Background samples must be collected in an area which has not been impacted by environmental contamination from the site and representative of natural background conditions. Based on waste type, contaminant mobility, operation practices, and soil type (sand, silty sand, clay), an estimate of contamination depth should be made and background samples taken at comparable depths for the particular soil type. Multiple soil horizons should have "background" established separately (e.g., minimum of four samples per each soil unit).

EXAMPLE:

Ground Surface		
Brown medium-coarse SAND		4 samples
Lt. brown silty fine SAND		4 samples
Gray silty CLAY w/trace of fine-med sand		4 samples

STATISTICAL ANALYSIS FOR ESTABLISHING BACKGROUND CONCENTRATIONS

The recommended statistical method for establishing background concentrations at small sites is (1) establishing the upper limit of background concentration of a constituent at the mean plus 3 standard deviations or (2) other statistical methods submitted to DNR for approval.

1. Mean Plus 3 Standard Deviation Approach

Calculate the "upper limit" of background concentration by using the following 5 step process.

- A. Calculate the background mean (\bar{X}_b) by dividing the sum of the total background readings by the total number of background readings:

$$\bar{X}_b = \frac{X_1 + X_2 + \dots + X_n}{n}$$

- B. Calculate the background variance (S_b^2) by taking the sum of the squares of each reading minus the mean and dividing by the degrees of freedom (the total number of background samples minus one):

$$S_b^2 = \frac{(X_1 - \bar{X}_b)^2 + (X_2 - \bar{X}_b)^2 + \dots + (X_n - \bar{X}_b)^2}{n - 1}$$

NOTE: Any sample populations less than (n < 30 samples)
must use n - 1 for degrees of freedom

- C. Calculate the background standard deviation (S_b) by taking the square root of the variance:

$$S_b = \sqrt{S_b^2}$$

D. The Coefficient of Variation Test (CV) where

$$CV = \frac{S_b}{\bar{X}_b}$$

is used to evaluate data distribution. The background data should generally have a CV of less than 0.5 for granular soils, less than 0.75 for cohesive soils, or an explanation accounting for higher CV values. The maximum recommended CV is 1. If the data distribution exceeds a CV of 1.0, then a thorough evaluation will need to be made to account for this variability (e.g., lab QA/QC, typographical errors, soil classification, sample location, data not normally distributed, etc.). If the CV exceeds 1.0 and there is sufficient evidence to suggest a data point does not accurately represent background conditions or if QA/QC problems exist which invalidate that data point, the outlier data may be dropped or additional samples collected and analyzed to ensure a sufficient representative data population (n) is achieved. A high concentration in and of itself is not sufficient justification to exclude the data point.

- E. Use the $\bar{X}_b + 3*S_b$ of "background" data as the maximum allowable limit or upper limit. Where $3*S_b$ equals three times the standard deviation and \bar{X}_b equals the background mean (this statistical method only requires one sample per station). Compare each sample point to the calculated maximum allowable limit or upper limit analyzed from background data.

EXAMPLE: Four sand samples from a site were analyzed for background concentrations for lead. Concentrations of lead from the sample analyses returned from the lab were 56, 25, 18, and 35 ppb. Now, the investigator wants to examine the data set to discover whether the 56 ppb sample is an outlier:

$$\bar{X}_b \text{ mean} = \frac{56 + 25 + 18 + 35}{4} = 33.5$$

$$S_b^2 = \frac{[56 - 33.5]^2 + [25 - 33.5]^2 + [18 - 33.5]^2 + [35 - 33.5]^2}{3} = 273.67$$

$$S_b = (\text{standard deviation}) = \sqrt{S_b^2} = 16.5$$

$$CV = \frac{16.5}{33.5} = 0.49$$

Because 0.49 is less than 0.5, no further evaluation of the background data set is necessary.

Therefore, the background upper limit value for this site is

$$\text{background upper limit} = \bar{X}_b + (3 * S_b) = 33.5 + (3 * 16.5) = 83.0 \text{ ppb}$$

If a value is found to be an outlier which is not representative of background conditions, it may be replaced by another sample that is not an outlier to maintain at least four samples for background determination.

2. *Other statistical procedures for establishing background.* Refer to a statistical reference book or US EPA's Interim Final Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (April 1989) and Addendum (July 1992).

PROCEDURES FOR NON-DETECT VALUES

The following provides some guidelines in incorporating non-detectable sample results into the procedure to calculate background concentrations.

1. If less than 50% of the background data is below the detection limit (DL), use $\frac{1}{2}$ of the detection limit as the value.
2. If more than 50% of the background data is below the detection limit, use one of the following procedures.
 - Alternate "O" and the detection limit (DL) resulting in a net value of $\frac{1}{2}$ of the detection limit with a variance.

EXAMPLE:

Actual Value	Substitute Value
<DL	DL
<DL	0
<DL	DL
<DL	0

- The Continuity Correction procedure with the t-test, Cohen's method, or other approved methods.

REPORT FOR SMALL SITE VERIFICATION

Soil cleanup verification reports for small sites must identify the number and location of samples and justify the sample location selected (why and how). The verification report must include the following.

1. MAP(s) and CROSS SECTIONS

Provide a scaled map of the floor and walls of an excavation (the vertical and horizontal area treated for in-situ remediations) with sample locations identified. The cross section should depict the stratigraphy, fractures, soil types, discolorations, unusual characteristics, odor, etc.

2. SAMPLE LOCATION RATIONALE

- A. Background sample locations
- B. Verification sample locations
- C. Sample depths
- D. Sample collection procedures
- E. Describe biases and rationale used for collecting each sample (e.g., clay fractures, discolored soil, location of leak in tank)

3. DATA ANALYSES

- A. Analytical parameters
- B. Analytical methods used
- C. Method detection limits
- D. Laboratory Quality Assurance/Quality Control

4. STATISTICAL ANALYSES

- A. Calculation of background concentrations
- B. Coefficient of variance calculations
- C. Lab results
- D. Narrative explanation of background concentrations

DNR—GUIDANCE DOCUMENT, PART 2

MEDIUM AND LARGE SITE SOIL CLEANUP VERIFICATION (GREATER THAN 10,890 SQUARE FEET)

Part 2 describes statistical random sampling strategies to verify the remediation of medium and large sites greater than 0.25 acres in size. The strategies employ the use of gridding to facilitate the unbiased selection of sampling points and accepted statistical tools for evaluating the resultant data. The strategies provide a 95% confidence level of determining any hot spot concentrations on a site. It contains guidance on sampling protocol and necessary documentation for clean closures. Part 2 also discusses how to establish grid intervals, set grids, sample grids, statistically evaluate the data, use grids to guide additional remedial activities, disposal options, reporting, and a certification checklist. It also provides guidance on the sampling of ex-situ remedial processes (e.g., thermal desorption).

The term 'clean closure' means that the site has been restored to either Type A or Type B levels. Type A is defined in Act 307 P.A. 1982, as amended, which references non-detect or background levels. Type B is defined in Act 307 P.A. 1982, as amended, which references risk-based or background levels. Waste, soil, other environmental media, and/or debris removed should be classified as hazardous or non-hazardous to determine disposal options and handling requirements (i.e., solid waste under Act 641 P.A. 1978, as amended; hazardous waste under Act 64 P.A. 1979, as amended; land ban restrictions under 40 CFR Part 268).

All cleanup verification evaluations must consider the spatial arrangements of sample values (patterned vs totally random) and the impacts on the present and future uses of the site. Because Type B cleanups are based on residual risk, the distribution of that risk, now and in the future, must be determined. These procedures are not *absolute*. Other sampling approaches may be developed and submitted for DNR approval.

Three of the statistical sampling strategies most commonly used for evaluating remedial sites and wastes are described in Attachment 2. For further discussion on sampling strategies and sample collection methods, see "Test Methods for Evaluating Solid Waste," SW-846 Volume II: Field Methods, November 1986, Third Edition, US EPA.

Compositing samples for verifying soil remediation is not acceptable without prior DNR approval. When verifying a soil remediation is complete, contaminant concentrations will be low. Compositing may result in the contaminant concentrations not being representative of what remains in the soil. If concentrations are low, compositing may dilute the concentrations of a contaminant to below its threshold detection limit. Additionally, if contamination is indicated in a composited sample, the location of the contamination remains unknown.

ESTABLISHING GRID INTERVALS

When obtaining samples to verify that soil or wastes have been adequately remediated, it is important to insure that the analytical results obtained will provide an accurate representation of the entire area or volume under consideration. The location and number of samples to be taken at a particular remediation site depends on many factors: the level of confidence desired, the spatial and temporal variability of the media to be sampled, and the costs involved. An important objective in any sampling program is to obtain the most accurate data possible while minimizing the associated costs. One method to accomplish this goal is to use statistically valid sampling strategies. The appropriate sample number can be estimated and the sampling locations can be chosen without bias.

Such strategies employ the use of gridding to facilitate the unbiased selection of sampling points and accepted statistical tools for evaluating the resultant data. Statistical theory allows for the sampling of a subset of the grid points to achieve a reliable characterization of the entire remedial area or waste. Subsections describe ways to use sampling grids and statistical tools to evaluate areas of remediation.

The following equations and tables provide a simple basis to establish a grid system to facilitate unbiased selection of sampling points and sample coverage proportional to the area being verified.

1. *Basic Strategies.* A grid system should be established over the area being remediated. Grid point representation should be proportional to the size of the area. For excavation, both the sidewalls and bottom areas would be included in the determination of the area size. It is recommended that one of the following equations be used to determine grid intervals for stationing:

small site: see Part 1

$$\text{medium site: } \frac{\sqrt{A/\pi}}{4} = GI$$

$$\text{large site: } \sqrt{\frac{A\pi}{SF}} = GI$$

WHERE:

A	=	area to be grid (square feet)
GI	=	grid interval
SF	=	Site Factor, length of area to be grid (unitless)

It appears that there are logical size ranges of sites to which the grid equations apply:

- A) small: up to 0.25 acre
- B) medium: 0.25 - 3.0 acres
- C) large: 3.0 acres and greater

To simplify this application, use the following chart based on an average size range of sites (1 acre = 43,560 square feet). The approximate grid ranges are provided as a quick check on numbers generated for specific sites using the above formulas.

<i>Site Acreage*</i>	<i>Square Feet*</i>	<i>≈ Grid Interval Ranges</i>
up to 0.25 (small)	up to 10,890	See Part 1
0.25-3.00 (medium)	10,890-130,680	15-50 feet
3.0 and over (large)	130,680 +	30 feet plus

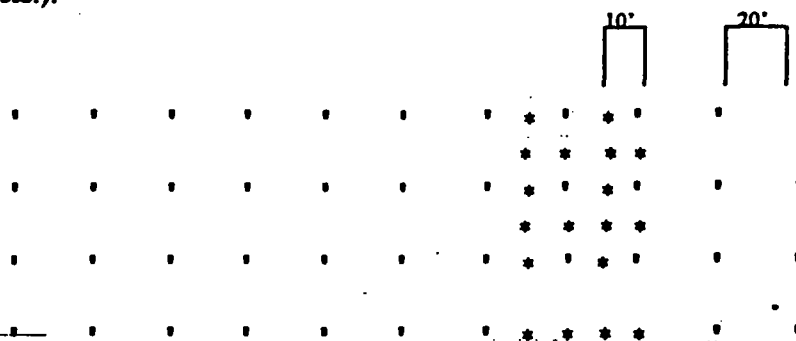
* Site acreage, square footage, is total area of sidewalls and base of excavation.

2. *Setting the Grid.* After the grid interval is calculated, it is recommended that a scaled grid overlay be made to superimpose on a map of the remediated area (this area includes both sidewalls and base). Some specified point (usually the southwest corner) should be designated as the 0,0 coordinate. The grid can then be adjusted to maximize sampling coverage. Some grid adjustment may be necessary for unusually shaped areas. Grid adjustment may also be needed to accommodate a minimum of at least one sample from each sidewall. Proposals for different grid strategies may be submitted for DNR review and approval on a case-by-case basis.

3. Variations on Basic Strategy.

- A. Subgridding. It may be warranted to apply grids with different intervals within the remediated area so that a proportional sampling can be focused on suspect areas (such as sumps, tank leak areas, etc.).

EXAMPLE:



' = Area I Sample Station, 80' x 200', GI = 20'

* = Area II (subset of I) Sample Station, 30' x 50', GI = 10'

- B. Further Randomization. Sites that may have a patterned distribution of waste or contamination due to time sequence of filling, production sequences, or physical site conditions (i.e., furrows) may require a further randomization of sampling. In such cases, the following grid cell sampling format may be selected instead of at grid point stations. Each grid cell to be sampled must be divided into nine equal sized "subcells." Next, a random number table is used to select in which of the subcells the sample will be taken. The random number table is used again to select which subcell for the next cell and so on.

EXAMPLE:

1	2	3	1	2	3
4	5	6	4	5	6
7	8	9	7	8	9

20'



Area = 120' x 200', GI = 20'

In the example above, a sampling grid has been set up with grid point stations 20 feet apart using the appropriate formula. Two cells which have been selected at random have been divided into nine subcells each. Subcell #4 was chosen randomly in one cell and subcell #2 in the other cell. This process is continued for all of the cells selected at random for sampling. Samples are then taken in each randomly chosen subcell.

C. Three dimensional gridding: In-Situ and Ex-Situ Remediations.

In-situ and ex-situ remediations involving soils and/or wastes with a significant vertical component should be evaluated in three dimensions (volume evaluation). Examples of such remediations would be in-situ soil vapor extraction or ex-situ bioremediation involving several cubic feet of soil and/or waste. A grid is superimposed on the remediation area as described in the previous sections and a vertical component is added at each node. The vertical sampling increments would be site specific and require prior approval from the DNR. Refer to Attachment 1 "Guide to Sample Bias" for additional guidance on vertical sampling increments.

SAMPLING OF GRID

Sampling of grids may include all of the grid stations or a phased subset of the total stations. The subset of grid stations is created by assigning coordinates to all the nodes and randomly selecting nodes using a random number generator or a random number table (refer to Attachment 2). A minimum of 12 samples or 25%, whichever is larger, of the total grid stations should be sampled and analyzed initially to allow a large enough data pool for statistical analysis. It is advisable that extra samples also be taken and kept under proper chain of custody and storage procedures at the time of initial sampling. If the statistical analysis indicates that more samples are needed, an additional sample trip to the field may have been avoided. A method for calculating the sample size requirements is presented in Attachment 2 (Lamda relationship).

ESTABLISHING SOIL BACKGROUND

Establishing soil background, as required by Act 307 PA 1982, as amended, Michigan Environmental Response Act (MERA), can be accomplished by utilizing Operational Memorandum #15 or using the following guidance.

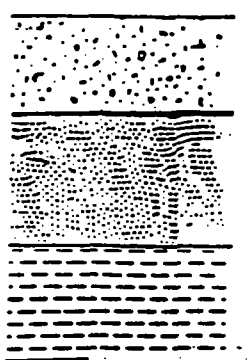
Background should be established for site specific waste constituents, specific chemicals used in various processes, facility operations, or remedial investigation results. Sample analyses may include metals, organic constituents, or other site specific waste constituents. Analyses should be in accordance with Act 307 P.A. 1982, as amended.

Many factors can play a part in the background concentrations of a chemical in soil.

EXAMPLE: The geologic origin (e.g., the parent rock) of glacial drift may have been high in copper, lead, or other metals that may be potential contaminants. Additionally, the hydrogeologic situation can alter the quantity of these elements. Groundwater recharge areas (e.g., highlands) are frequently leached of metals while groundwater discharge areas (e.g., swamps, floodplain) are the recipients of leached metals. Thus, sites in low areas will usually have higher background concentrations than upland areas. Other conditions, such as precipitation and atmospheric fallout from widely dispersed human and natural activities, also affect soil concentrations.

A minimum of four samples must be used to establish "background" in soils. This will help account for natural constituent occurrences and inherent variability within each distinctive soil horizon. Background samples must be collected in an area which has not been impacted by environmental contamination from the site and representative of natural background conditions. Based on waste type, contaminant mobility, operation practices, and soil type (sand, silty sand, clay), an estimate of contamination depth should be made and background samples taken at comparable depths for the particular soil type. Multiple soil horizons should have "background" established separately (e.g., minimum of four samples per each soil unit).

EXAMPLE:

Ground Surface		
Brown medium-coarse SAND		4 samples
Lt. brown silty fine SAND		4 samples
Gray silty CLAY w/trace of fine-med sand		4 samples

STATISTICAL ANALYSIS FOR ESTABLISHING BACKGROUND CONCENTRATIONS

The recommended statistical method(s) for establishing background concentrations at medium and large sites are (1) establishing the upper limit of background concentration of a constituent at the mean plus 3 standard deviations, (2) tolerance limit, (3) t-tests, and (4) other statistical methods submitted to the DNR for approval.

1. *Mean Plus 3 Standard Deviation Approach.*

Calculate the "upper limit" of background concentration by using the following 5 step process.

- A. Calculate the background mean (\bar{X}_b) by dividing the sum of the total background readings by the total number of background readings:

$$\bar{X}_b = \frac{X_1 + X_2 + \dots + X_n}{n}$$

- B. Calculate the background variance (S_b^2) by taking the sum of the squares of each reading minus the mean and dividing by the degrees of freedom (the total number of background samples minus one):

$$S_b^2 = \frac{(X_1 - \bar{X}_b)^2 + (X_2 - \bar{X}_b)^2 \dots (X_n - \bar{X}_b)^2}{n-1}$$

NOTE: Any sample populations less than ($n < 30$ samples)
must use $n - 1$ for degrees of freedom

- C. Calculate the background standard deviation (S_b) by taking the square root of the variance:

$$S_b = \sqrt{S_b^2}$$

- D. The Coefficient of Variation Test (CV) where

$$CV = \frac{S_b}{\bar{X}_b}$$

is used to evaluate data distribution. The background data should generally have a CV of less than 0.5 for granular soils, less than 0.75 for cohesive soils, or an explanation accounting for higher CV values. The maximum recommended CV is 1. If the data distribution exceeds a CV of 1.0, then a thorough evaluation will need to be made to account for this variability (e.g., lab QA/QC, typographical errors, soil classification, sample location, data not normally distributed etc.). If the CV exceeds 1.0 and there is sufficient evidence to suggest a data point does not accurately represent background conditions or if QA/QC problems exist which invalidate that data point, the outlier data may be dropped or additional samples collected and analyzed to ensure a sufficient representative data population (n) is achieved. A high concentration in and of itself is not sufficient justification to exclude the data point.

- E. Use the $\bar{X}_b + 3*S_b$ of "background" data as the maximum allowable limit or upper limit. Where $3*S_b$ equals three times the standard deviation and \bar{X}_b equals the background mean (this statistical method only requires one sample per station). Compare each sample point to the calculated maximum allowable limit or upper limit analyzed from background data or utilize a statistical characterization approach with UCL calculations.

EXAMPLE: Four sand samples from a site were analyzed for background concentrations for lead. Concentrations of lead from the sample analyses returned from the lab were 56, 25, 18, and 35 ppb. Now, the investigator wants to examine the data set to discover whether the 56 ppb sample is an outlier.

$$\bar{X}_b \text{ mean} = \frac{56 + 25 + 18 + 35}{4} = 33.5$$

$$S_b^2 = \frac{[56 - 33.5]^2 + [25 - 33.5]^2 + [18 - 33.5]^2 + [35 - 33.5]^2}{3} = 273.67$$

$$S_b = (\text{standard deviation}) = \sqrt{S_b^2} = 16.5$$

$$CV = \frac{16.5}{33.5} = 0.49$$

Because 0.49 is less than 0.5, no further evaluation of the background data set is necessary. Therefore, the background upper limit value for this site is

$$\text{background upper limit} = \bar{X}_b + (3 * S_b) = 33.5 + (3 * 16.5) = 83.0 \text{ ppb}$$

If a value is found to be an outlier which is not representative of background conditions, it may be replaced by another sample that is not an outlier to maintain at least four samples for background determination.

2. **Tolerance Limit.** This statistical procedure is a fairly sensitive program for environmental purposes. It minimizes false positive and is simple to perform. A minimum background data base of $n=8$ (optimum $n=16$) is needed for this method. Other suggested criteria follow:
 - A. The Coefficient of Variation Test (CV) to evaluate data distribution. See this Guidance Document, Part 2, Statistical Analysis for Establishing Background Concentrations, #1.D. (the Coefficient of Variation Test....).
 - B. Using the mean (\bar{X}_b) and standard deviation (S_b), construct the one-sided upper tolerance limit (TL) by taking the mean plus a tolerance coefficient (K) at the 95% probability level for a 95% coverage (for K values, see Attachment 3) times the standard deviation as follows:

$$TL = \bar{X}_b + K S_b$$

3. *t-tests.* Any t-test should be "approved" by DNR prior to use since there are a number of variations. The Gosset Student t-test (1908) or Cochran's Approximation to the Behren's-Fisher Student's t-test as referenced in the 40 CFR Part 264, Appendix IV, are recommended. Note that these statistical comparison methods require that two or more discrete samples be taken at each sampling station.
4. *Other statistical procedures for establishing background.* Refer to a statistical reference book or US EPA's Interim Final Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (April 1989) and Addendum (July 1992).

PROCEDURES FOR NON-DETECT VALUES

The following provides some guidelines in incorporating non-detectable sample results into the procedure to calculate background concentrations.

1. If less than 50% of the background data is below the detection limit (DL), use $\frac{1}{2}$ of the detection limit as the value.
2. If more than 50% of the background data is below the detection limit, use one of the following procedures.
 - Alternate "O" and the detection limit (DL) resulting in a net value of $\frac{1}{2}$ of the detection limit, with a variance

EXAMPLE:	Actual Value	Substitute Value
	<DL	DL
	<DL	0
	<DL	DL
	<DL	0

- The Continuity Correction procedure with the t-test, Cohen's method, or other approved methods.

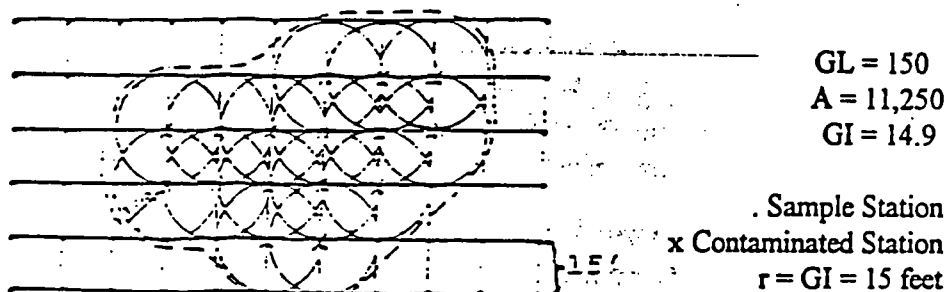
STATISTICAL EVALUATION OF DATA

A detailed description of an acceptable approach for evaluating the data generated by statistically based random sampling strategies such as those described in the foregoing sections is provided in Attachment 2 (page 29). The 95% upper confidence limit (UCL) of the mean is calculated for each constituent of concern and compared to the regulatory threshold (RT) (i.e., cleanup criterion; e.g., Type A or B). If the UCL is less than the RT and an adequate number of samples have been collected and spatially evaluated, the remediation is deemed complete. Attachment 2 also provides a step wise procedure for determining whether an adequate number of samples have been collected, based on the analytical data derived from the initial and subsequent rounds of samples. All evaluations must consider the spatial correlation of sample values (e.g., highest concentrations in the same area), present and future uses of the site, residual risk, and distribution of that risk now and in the future. Other acceptable methods for UCL and sample size calculations can be found in US EPA SW-846, Third Edition, Section 9.1.1.3.

GRID APPROACH TO ADDITIONAL REMEDIATION

1. *Two-Dimensional Node Sampling Excavation Grid.* Verification sampling as described above will at times indicate that remediation is incomplete. Excavation of contaminated areas should be based on the established grid system interval (as recommended in this Guidance Document, Part 2). Where a subset of grid points has indicated that the entire area exceeds the cleanup, the nodes adjacent to the sampled nodes that are causing the exceedance should be sampled, and this process repeated until the "Hot spots" requiring removal have been defined. The radius of excavation around the contaminated sample point(s) is equal to the grid interval ($GI=r$). Excavation depth is to the deepest point of contamination or to the depth where acceptable levels are anticipated. After excavation, the impacted point(s) must be resampled at their new elevations to verify that the area meets the selected cleanup criteria. If continued contamination is detected, the excavation format is repeated until a satisfactory result is obtained.

EXAMPLE:



Remediation of contaminated soil by excavation will be in accordance with Act 307 P.A. 1982, as amended. The proposed remedial action plan must be approved by the DNR.

2. *Two-Dimensional Subcell Sampling Excavation Grid.* Use this Guidance Document, Part 2. The radius of excavation around a contaminated point may need to be adjusted to greater than the GI distance. This adjustment is due to the variable distances between sampling points.
3. *Three-Dimensional Cleanup Verification.* If sampling and statistical analysis using this Guidance Document indicate that Act 307 cleanup criteria have not been met, additional remediation will be required. The sampling protocol and strategies described in Attachment 2 and in SW-846, Third Edition, Volume II, Part III, Chapter 9, are acceptable. All sampling strategies, detection levels, and sampling pathways must be in accordance with Act 307 P.A. 1982, as amended. If any portion of the soil mass in question appears to be causing the material to fail, it may be identified through hot spot sampling and selectively removed. Subsequent sampling must be done to confirm that the remaining material meets Act 307 P.A. 1982, as amended.
4. *Batch Sampling for ex-situ treatment processes.* If ex-situ treatment processes of contaminated soil or waste is used in the remediation, a sampling program for the process stream needs to be developed. The basis of this program is to get representative samples over time versus a spatial approach (Attachment 2, Sampling Process Streams).

DISPOSAL OPTIONS

Soils remediated to Act 307 P.A. 1982, as amended, standards (Type A and/or Type B) are no longer considered a waste per Act 64 P.A. of 1979, as amended, and RCRA regulations. Disposal of excavated waste, soil, other environmental media, and/or debris must be in accordance with all applicable Federal, State, and local regulations.

REPORT FOR MEDIUM AND LARGE SITES VERIFICATION

Soil cleanup verification reports for medium and large sites must identify the number and location of samples and justify the sample location selected (why and how). The verification report must include the following.

1. **MAP(S) AND CROSS SECTIONS**
Provide a scaled map of the floor and walls of the excavation (the vertical and horizontal area treated for in-situ remediations) with sample grid and sample locations identified. Appropriate cross section should depict the stratigraphy, fractures, soil types, and final depth and elevations of the excavation.
2. **SAMPLE LOCATION RATIONALE**
 - a. Properly labeled and easily identified sampling grid stations (map) including background stations
 - b. Sample Depths
 - c. Sample Collection Procedures
 - d. Results of all tests to determine clean closure (charts, tables, lab sheets, field notes, well logs, boring logs)
3. **DATA ANALYSES**
 - a. Analytical parameters
 - b. Analytical methods used
 - c. Method detection limits
 - d. Laboratory Quality Assurance/Quality Control
4. **STATISTICAL ANALYSES**
 - a. Explanation and calculation of background concentrations
 - b. Statistical comparisons on sampling results compared to background (this should include full computations on background and statistical analysis)
 - c. Lab results
5. Additional information to support closure (e.g., residual risks, spatial correlation of sample values, present and future land uses)

RCRA CLEAN CLOSURE CERTIFICATION CHECKLIST

Attachment 4 is a guide that indicates the information that a facility should provide to certify that their activities meet the conditions for a clean closure under the Act 64/RCRA regulations.

ATTACHMENT 1

GUIDE TO SAMPLE BIAS

Many factors can play a part in the concentrations of contaminants. The following contains some of the factors impacting chemical concentrations and locations.

CHEMICAL TRANSFORMATIONS

Many organic chemicals may undergo aerobic and anaerobic degradation. A description of these processes is beyond the scope of this document. The subject is approached here, however, to be sure that samplers are aware that the chemical(s) spilled may not be the only chemical(s) in the soil after a transformation has occurred. These occurrences should be documented in the remedial investigation. The full scan of chemicals from the remedial investigation requiring cleanup should be analyzed when doing a closure. Analyses should be done for all chemicals that have been identified as breakdown products of the chemicals found on-site.

The professional literature contains many articles on this subject (Cline and Brown, 1989; Borden and Bedient, 1987; Wilson and Wilson, 1985). The interested reader is directed to these articles.

Organic Carbon Content of Soil

The organic carbon content of soils is a key factor in the ability of any soil to adsorb contaminants. For a variety of reasons (Lindsay, 1979), an increase in organic carbon content leads to an increase in the adsorption of several classes of chemicals.

Where to sample: Areas of the excavation that appear to have excess organic carbon (e.g. peat, muck, darker soils) should be preferentially sampled.

Medium Sand or Larger Grains

Medium to larger grain size sand has from 20 to 40 percent porosity. Most sands in Michigan are composed of quartz, limestone, and small amounts of metamorphic rock fragments. These soils have a low capacity for adsorbing metals or hydrophilic (soluble) organic chemicals. Hydrophobic (insoluble) organic chemicals with low molecular weight will adsorb to this soil in small amounts. Hydrophobic chemicals with high molecular weight will adsorb in moderate amounts (Cline & Brown, 1989). These soils have a low capacity to hold contaminants in the grain interstices due to low capillary action. Contaminants that are held in these soils adhere to the grains themselves in dry soils and are forced into the smaller pore spaces in wet soils (Schwille, 1988).

Where to sample: Samples should be placed at regular intervals along the base and sidewalls of the excavation being sure that samples are located where the source was removed. In these soils, the capillary force is low enough to ignore its effects in transporting contaminants lateral to gravity. Therefore, sidewall samples should be located near the excavation floor. This is especially true for low surface tension products such as gasoline.

The limestone sand grains can act as a buffer to contaminants that cause pH changes (e.g., steel mill pickling acids). For these types of contaminants, the sampler should be on the lookout for intra-granular precipitates. These can appear as grain surface staining or make the soil appear clumpy or aggregated. Soils containing precipitates should be sampled.

Fine Sand and Silt

These soils have strong capillary action due to the small inter-granular distances. A determination of the fluid surface tension of the spilled product is helpful. High surface tension aids in the ability of a substance to overcome gravity by capillary action. As before, higher molecular weight products can be expected to adsorb to the grains to a greater degree. This allows a product to move lateral to gravity and, to a degree, upward from the leak location. Low surface tension products, such as TCE (trichloroethene), are more likely to go straight down than oils in these kinds of soils. However, the hydraulic head (i.e., the amount of product in the original spill) must be substantial to force a dense non-aqueous phase liquid through a media with a hydraulic conductivity less than 1×10^{-3} cm/sec (Schwille, 1988).

Where to sample: Interfaces between fine sand layers with larger grains above should be sampled. When high surface tension contaminants are suspected, silt layers should be sampled.

Clays

Clay soils are very different from the sands and silts. Clays possess a net negative charge. This causes heavy metal cations (e.g., Cr^{+6} , Cd^{+2} , Pb^{+2}) to adsorb to the clay surface. In fact, this is true for any positive ionizable substance. Clays also have a much greater secondary porosity than primary (primary porosity is the space between the soil particles; secondary porosity is the space between fractures, bedding planes, and soil structures). As a result, spills in clay soils tend to follow preferred pathways. Clays will often show signs of shrinkage cracks or fractures that will allow contaminants to migrate in what would otherwise be considered a "tight" soil in a lab analysis of permeability. Signs of fracturing include "patterned" mottling. This is where the Fe (and also Mn) will be oxidized to a red, yellow, or reddish brown color along the crack while the matrix remains the reduced blue/gray color (Lindsay, 1979).

Where to sample: It is very important to take clay soil samples from fractures. The fractures are the avenue of travel for contaminants in clay soils. Clay soils may also have sand lenses which should always be sampled. Sand lenses in clays tend to collect fluids. As such, they may harbor contaminants.

Bedrock

Excavations in bedrock present difficult problems. Unlike clay, some bedrock formations have substantial primary porosity as well as secondary porosity. In Michigan, these are sandstones, conglomerates, and brecciated/coarse grained limestones. Examples of bedrock in Michigan with low primary porosity are fine grained limestones, shale, and crystalline metamorphic rocks (e.g., gneiss). If the sampler is unaware of the type of bedrock that is in an excavation, a geologist must be consulted.

Where to sample: Excavations in areas of bedrock with significant primary porosity must be sampled in both the fractures and the matrix. Bedrock without primary porosity should have sampling predominantly in the fractures as in the clay situation. Weathered zones in bedrock will hold contaminants better than unweathered zones. This is due to the increased number of adsorption sites available in weathered rock.

ATTACHMENT 2

SAMPLING PROTOCOL FOR CHARACTERIZING WASTE/TREATMENT LEVELS:

STRATEGIES FOR EVALUATING TREATED SOILS AND WASTE MATERIALS

When obtaining samples to characterize a treated soil or waste material, it is important to insure that the analytical results obtained will provide an accurate estimation of the nature of the entire area/volume under consideration. The location and number of samples to be taken at a particular site depend on many factors: the degree of accuracy desired, the spatial and temporal variability of the media to be sampled, and the costs involved. An important objective in any sampling program is to obtain the most accurate data possible while minimizing the associated costs. One method to accomplish this goal is to use statistically valid sampling strategies. The appropriate sample number can be estimated and the sampling locations can be chosen without bias.

Attachment 2 provides information on the methods used to obtain accurate data while minimizing the costs. The attachments include a discussion of three statistical sampling strategies and methods to determine the appropriate grid size for the area under investigation. If several areas on a site are under investigation, it may be advisable to grid them separately. This is especially true if information does not exist to indicate that the areas contain similar constituents or that they were placed at the same time period.

Information is also supplied on the statistical evaluation of the resultant analytical data. A minimum of 12 samples or 25%, whichever is greater, of the total grid stations should be sampled and analyzed initially to allow a large enough data pool for the statistical analysis. Extra samples should be taken and kept under proper chain of custody and handling procedures at the time of initial sampling. If the statistical analysis indicates that two or three more samples are needed, an additional trip to the field may not be necessary. This may also avoid the need to reestablish the grid pattern at a later date.

For further discussion on sampling strategies and sample collection methods, see "Test Methods for Evaluating Solid Waste," SW-846 Volume II: Field Methods, November 1986, Third Edition, US EPA.

STATISTICAL SAMPLING STRATEGIES

Statistical sampling strategies can often produce increased data accuracy while eliminating sampler bias. Random sampling is based on the theory of random chance probabilities in order to choose the most representative sample. Knowledge of the waste distribution is not necessary. The error in data accuracy of a random sampling scheme can be objectively measured since the probability of choosing each sampling point is known. A random numbers table (attached) or a random numbers generator should be used to select the sampling locations eliminating bias by the sample collector.

Several statistical sampling strategies are available to produce an unbiased, representative sampling program. The principles behind three of these and the situations for which they are best suited are provided below. To achieve true random sampling, composite sampling is not acceptable.

1. *Simple Random* is a method that requires little or no prior knowledge of material distribution. It relies on random chance probability theory—where each sampling location has an equal and known probability of being selected. In this way, sampling error can be accurately estimated. Usually, the area of interest is sectioned into a two or three dimensional grid pattern and random coordinates are chosen for sampling.
2. *Systematic random* is an extension of simple random sampling that may produce a more efficient sampling survey. It can be more efficient by reducing the sampling error while maintaining the sample number, or by reducing the number of samples needed to achieve a specified sampling error, or by reducing the cost of collection. This method also requires little or no knowledge about the waste distribution, but bias and imprecision can be introduced if unseen trends or cycles exist. Two methods used to select sample locations under this method follow.
 - A) randomly selecting a transect or transects and sampling at preselected intervals
 - B) preselecting both the transect or transects and the sampling interval and starting from a randomly selected point.
3. *Stratified random sampling* requires some knowledge about the waste distribution. When stratification is known or suspected, sampling efficiency can be improved by dividing the material into strata that are more homogeneous than the total area. Simple random sampling techniques can then be used to sample each stratum independently. Each stratum is divided into a grid pattern and the sampling points are selected randomly. If the area is vertically stratified, the sampling points in each stratum are selected randomly and then selected depths are sampled. If the area is horizontally stratified, the sampling points within each stratum are selected randomly, but the total depth is sampled. An analysis of variance (ANOVA) should be done on the analytical results to determine if the strata differ significantly. This is done to assure that the use of stratified random sampling was statistically valid. When the volume of the strata differ or the number of samples within each strata differs, the results must be weighed appropriately to avoid bias.

RANDOM NUMBERS TABLE

HOW TO USE THE RANDOM NUMBERS TABLE

1. Determine the number of samples you need to take. Identify the number of digits necessary to cover the sample population (e.g., for a sample population of 55, two digits are necessary to cover the selected grid stations 01 through 55).
2. Using the random numbers table, choose any number as a starting point.
3. From this starting point number, go in any direction and continue in the same direction and pattern sequence until you have selected the predetermined number of samples with no repetitions. Numbers larger than the population size are ineligible (e.g., numbers greater than 55 in the example are ineligible).

Line/Col	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	10480	15011	01536	02011	81647	91646	69179	14194	62590	36207	20969	99570	91291	90700
2	22368	46573	25595	85393	30995	89198	27982	53402	93965	34095	52666	19174	39615	99505
3	24130	48360	22527	27265	76393	64809	15179	24830	49340	32081	30680	19655	63348	58629
4	42167	93093	06243	61680	07856	16376	39440	53537	71341	57004	00849	74917	97758	16379
5	37570	39975	81837	16656	06121	91782	60468	81305	49684	60672	14110	06927	01263	54613
6	77921	06907	11008	42751	27756	53498	18602	70659	90655	15053	21916	81825	44394	42880
7	99562	72905	56420	69994	98872	31016	71194	18738	44013	48840	63213	21069	10634	12952
8	96301	91977	05463	07972	18876	20922	94595	56869	69014	60045	18425	84903	42508	32307
9	89579	14342	63661	10281	17453	18103	57740	84378	25331	12566	58678	44947	05585	56941
10	85475	36857	43342	53988	53060	59533	38867	62300	08158	17983	16439	11458	18593	64952
11	28918	69578	88231	33276	70997	79936	56865	05859	90106	31595	01547	85590	91610	78188
12	63553	40961	48235	03427	49626	69445	18663	72695	52180	20847	12234	90511	33703	90322
13	09429	93969	52636	92737	88974	33488	36320	17617	30015	08272	84115	27156	30613	74952
14	10365	61129	87529	85689	48237	52267	67689	93394	01511	26358	85104	20285	29975	89868
15	07119	97336	71048	08178	77233	13916	47564	81056	97735	85977	29372	74461	28551	90707
16	51085	12765	51821	51259	77452	16308	60756	92144	49442	53900	70960	63990	75601	40719
17	02368	21382	52404	60268	89368	19885	55322	44819	01188	65255	64835	44919	05944	55157
18	01011	54092	33362	94904	31273	04146	18594	29852	71585	85030	51132	01915	92747	64951
19	52162	53916	46369	58586	23216	14513	83149	98736	23495	64350	94738	17752	35156	35749
20	07056	97628	33787	09998	42698	06691	76988	13602	51851	46104	88916	19509	25625	58104
21	48663	91245	85828	14346	09172	30168	90229	04734	59193	22178	30421	61666	99904	32812
22	54164	58492	22421	74103	47070	25306	76468	26384	58151	06646	21524	15227	96909	44592
23	32639	32363	05597	24200	13363	38005	94342	28728	35806	06912	17012	64161	18296	22851
24	29334	27001	87637	87308	58731	00256	45834	15398	46557	41135	10367	07684	36188	18510
25	02488	33062	28834	07351	19731	92420	60952	61280	50001	67658	32586	86679	50720	94953

Line/Col	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
26	81525	72295	04839	96423	24878	82651	66566	14778	76797	14780	13300	87074	79666	95725
27	29676	20591	68086	26432	46901	20849	89768	81536	86645	12659	92259	57102	80428	25280
28	00742	57392	39064	66432	84673	40027	32832	61362	98947	96067	64760	64584	96096	98253
29	05366	04213	25669	26422	44407	44048	37937	63904	45766	66134	75470	66520	34693	90449
30	91921	26418	64117	94305	26766	25940	39972	22209	71500	64568	91402	42416	07844	69618
31	00582	04711	87917	77341	42206	35126	74087	99547	81817	42607	43808	76655	62028	76630
32	00725	69884	62797	56170	86324	88072	76222	36086	84637	93161	76038	65855	77919	88006
33	69011	65797	95876	55293	18988	27354	26575	08625	40801	59920	29841	80150	12777	48501
34	25976	57948	29888	88604	67917	48708	18912	82271	65424	69774	33611	54262	85963	03547
35	09763	83473	73577	12908	30883	18317	28290	35797	05998	41688	34952	37888	38917	88050
36	91567	42595	27958	30134	04024	86385	29880	99730	55536	84855	29080	09250	79656	73211
37	17955	56349	90999	49127	20044	59931	06115	20542	18059	02008	73708	83517	36103	42791
38	46503	18584	18845	49618	02304	51038	20655	58727	28168	15475	56942	53389	20562	87338
39	92157	89634	94824	78171	84610	82834	09922	25417	44137	48413	25555	21246	35509	20468
40	14577	62765	35605	81263	39667	47358	56873	56307	61607	49518	89656	20103	77490	18062
41	98427	07523	33362	64270	01638	92477	66969	98420	04880	45585	46565	04102	46880	45709
42	34914	63976	88720	82765	34476	17032	87589	40836	32427	70002	70663	88863	77775	69348
43	70060	28277	39475	46473	23219	53416	94970	25832	69975	94884	19661	72828	00102	66794
44	53976	54914	06990	67245	68350	82948	11398	42878	80287	88267	47363	46634	06541	97809
45	76072	29515	40980	07391	58745	25774	22987	80059	39911	96189	41151	14222	60697	59583
46	90725	52210	83974	29992	65831	38857	50490	83765	55657	14361	31720	57375	56228	41546
47	64364	67412	33339	31926	14883	24413	59744	92351	97473	89286	35931	04110	23726	51900
48	08962	00358	31662	25388	61642	34072	81249	35648	56891	69352	48373	45578	78547	81788
49	95012	68379	93526	70765	10593	04542	76463	54328	02349	17247	28865	14777	62730	92277
50	15664	10493	20492	38391	91132	21999	59516	81652	27195	48223	46751	22923	32261	856
51	16408	81899	04153	53381	79401	21438	83035	92350	36693	31238	59649	91754	72772	02338
52	18629	81953	05520	91962	04739	13092	97662	24822	94730	06496	35090	04822	86772	98289
53	73115	35101	47498	87637	99016	71060	88824	71013	18735	20286	23153	72924	35165	43040
54	57491	16703	23167	49323	45021	33132	12544	41035	80780	45393	44812	12515	98931	91202
55	30405	83946	23792	14422	15059	45799	22716	19792	09983	74353	68668	30429	70735	25499
56	16631	35006	85900	98275	32388	52390	16815	69298	82732	38480	73817	32523	41961	44437
57	96773	20206	42559	78985	05300	22164	24369	54224	35083	19687	11052	91491	60383	19746
58	38935	64202	14349	82674	66523	44133	00697	35552	35970	19124	63318	29686	03387	59846
59	31624	76384	17403	53363	44167	64486	64758	75366	76554	31601	12614	33072	60332	92325
60	78919	19474	23632	27889	47914	02584	37680	20801	72152	39339	34806	08930	85001	87820
61	03931	33309	57047	74211	63445	17361	62825	39908	05607	91284	68833	25570	38818	46920
62	74426	33278	43972	10119	89917	15665	52872	73823	73144	88662	88970	74492	51805	99378
63	09066	00903	20795	95452	92648	45454	09552	88815	16553	51125	79375	97596	16296	66092
64	42238	12426	87025	14267	20979	04508	64535	31355	86064	29472	47689	05974	52468	16834
65	16153	08002	26504	41744	81959	65642	74240	56302	00033	67107	77510	70625	28725	34191
66	21457	40742	29820	96783	29400	21840	15035	34537	33310	06116	95240	15957	16572	06004
67	21581	57802	02050	89728	17937	37621	47075	42080	97403	48626	68995	43805	33386	21597
68	55612	78095	83197	33732	05810	24813	86902	60397	16489	03264	88525	42786	05269	92532
69	44657	66999	99324	51281	84463	60563	79312	93454	68876	25471	93911	25650	12682	73572
70	91340	84979	46949	81973	37949	61023	43997	15263	80644	43942	89203	71795	99533	50501
71	91227	21199	31935	27022	84067	05462	35216	14486	29891	68607	41867	14951	91696	85063
72	50001	38140	66321	19924	72163	09538	12151	06878	91903	18749	34405	56087	82790	70923
73	65390	05224	72958	28609	81406	39147	25549	48542	42627	45233	57202	94617	23772	07896
74	27504	96131	83944	41575	10573	08619	64482	73923	36152	05184	94142	25299	84387	34925
75	37169	94851	39117	89632	00959	16487	65536	49071	39782	17095	02330	74301	00275	48280

ne/Col	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
76	11508	70225	51111	38351	19444	66499	71945	05422	13442	78675	84081	66938	93654	59894
77	37449	30362	06694	54690	04052	53115	62757	95348	78662	11163	81651	50245	34971	52924
78	46515	70331	85922	38329	57015	15765	97161	17869	45349	61796	66345	81073	49106	79860
79	30986	81223	42416	58353	21532	30502	32305	86482	05174	07901	54339	58861	74818	46942
80	63798	64995	46583	09765	44160	78128	83991	42865	92520	83531	80377	35909	81250	54238
81	82486	84846	99254	67632	43218	50076	21361	64816	51202	88124	41870	52689	51275	83556
82	21885	32906	92431	09060	64297	51674	64126	62570	26123	05155	59194	52799	28225	85762
83	60336	98782	07408	53458	13564	59089	26445	29789	85205	41001	12535	12133	14645	23541
84	43937	46891	24010	25560	86355	33941	25786	54990	71899	15475	95434	98227	21824	19585
85	97656	63175	89303	16275	07100	92063	21942	18611	47348	20203	18534	03862	78095	50136
86	03299	01221	05418	38982	55758	92237	26759	86367	21216	98442	08303	56613	91511	75928
87	79626	06486	03574	17668	07785	76020	79924	25651	83325	88428	85076	72811	22717	50585
88	85636	68335	47539	03129	65651	11977	02510	26113	99447	68645	34327	15152	55230	93448
89	18039	14367	61337	06177	12143	46609	32989	74014	64708	00533	35398	58408	13261	47908
90	08362	15656	60627	36478	65648	16764	53412	09013	07832	41574	17639	82163	60859	75367
91	79556	29068	04142	16268	15387	12856	66227	38358	22478	73373	88732	09443	82558	05250
92	92608	82674	27072	32534	17075	27698	98204	63863	11951	34648	88022	56148	34925	57031
93	23982	25835	40055	67006	12293	02753	14827	22235	35071	99704	37543	11601	35503	85171
94	09915	96306	05908	97901	28395	14186	00821	80703	70426	75647	76310	88717	37890	40129
95	50937	33300	26695	62247	69927	76123	50842	43834	86654	70959	79725	93872	28117	19233
96	42488	78077	69882	61657	34136	79180	97526	43092	04098	73571	80799	76536	71255	64239
97	46764	86273	63003	93017	31204	36692	40202	35275	57306	55543	53203	18098	47625	88684
98	03237	45430	55417	63282	90816	17349	88298	90183	36600	78406	06216	95787	42579	90730
99	86591	81482	52667	61583	14972	90053	89534	76036	49199	43716	97548	04379	46370	28672
100	38534	01715	94964	87288	65680	43772	39560	12918	86537	62738	19636	51132	25739	56947
101	13284	16834	74151	92027	24670	36665	00770	22878	02179	51602	07270	76517	97275	45960
102	21224	00370	30420	03883	96648	89428	41583	17564	27395	63904	41548	49197	82277	24120
103	99052	47887	81085	64933	66279	80432	65793	83287	34142	13241	30590	97760	35848	91983
104	00199	50993	98603	38452	87890	94624	69721	57484	67501	77638	44331	11257	71131	11059
105	60578	06483	28733	37867	07936	98710	98539	27186	31237	80612	44488	97819	70401	95419
106	91240	18312	17441	01929	18163	69201	31211	54288	39296	37318	65724	90401	79017	62077
107	97458	14229	12063	59611	32249	90466	33216	19358	02591	54263	88449	01912	07436	50813
108	35249	38646	34475	72417	60514	69257	12489	51924	86871	92446	36607	11458	30440	52639
109	38980	46600	11759	11900	46743	27860	77940	39298	97838	95145	32378	68038	89351	37005
110	10750	52745	38749	87365	58959	53731	89295	59062	39404	13198	59960	70408	29812	83126
111	36247	27850	73958	20673	37800	63835	71051	84724	52492	22342	78071	17456	96104	18327
112	70994	66986	99744	72438	01174	42159	11392	20724	54322	36923	70009	23233	65438	59685
113	99638	94702	11463	18148	81386	80431	90628	52506	02016	85151	88598	47821	00265	82525
114	72055	15774	43857	99805	10419	76939	25993	03544	21560	83471	43989	90770	22965	44247
115	24038	65541	85788	55835	38835	59399	13790	35112	01324	39520	76210	22467	83275	32286
116	74976	14631	35908	28221	39470	91548	12854	30166	09073	75887	36782	00268	97121	57676
117	35553	71628	70189	26436	63407	91178	90348	55359	80392	41012	36270	77786	89578	21059
118	35676	12797	51434	82976	42010	26344	92920	92155	58807	54644	58581	95331	78629	73344
119	74815	67523	72985	23183	02446	63594	98924	20633	58842	85961	07648	70164	34994	67662
120	45246	88048	65173	50989	91060	89894	36063	32819	68559	99221	49475	50558	34698	71800
121	76509	47069	86378	41797	11910	49672	88575	97966	32466	10083	54728	81972	58975	30761
122	19689	90332	04315	21358	97248	11188	39062	63312	52496	07349	79178	33692	57352	72862
123	42751	35318	97513	61537	54955	08159	00337	80778	27507	95478	21252	12746	37554	97775
124	11946	22681	45045	13964	57517	59419	58045	44067	58716	58840	45557	96345	33271	53464
125	96518	48688	20996	11090	48396	57177	83867	86464	14342	21545	46717	72364	86954	55580

SAMPLING GRIDS

1. A grid system should be established over the specified area (sidewalls and base). Grid point representation should be proportioned to the size of the area. It is recommended that one of the following equations be used to determine grid intervals for stationing.

$$\text{small site} \quad \frac{\sqrt{A/\pi}}{2} = GI$$

$$\text{medium site} \quad \frac{\sqrt{A/\pi}}{4} = GI$$

$$\text{large site} \quad \sqrt{\frac{A\pi}{SF}} = GI$$

where: A = area to be grid (sq. ft.)
 GI = grid interval
 SF = Site Factor, length of area to be grid (unitless)

It appears that there are logical size ranges of sites to which the three equations apply:

- A) small up to 0.25 acre
- B) medium: 0.25 - 3.0 acres, and
- C) large: 3.0 acres and greater

To simplify this application, use the following chart based on an average size range of sites (1 acre = 43,560 square feet). The approximate grid ranges are provided as a quick check on numbers generated for specific sites using the above formulas.

<i>Site Acreage*</i>	<i>Square Feet*</i>	<i>≈ Grid Interval Ranges</i>
up to 0.25 (small)	up to 10,890	See Part 1
0.25-3.00 (medium)	10,890-130,680	15-50 feet
3.0 and over (large)	130,680 +	30 feet plus

* Site acreage, square footage, is total area of sidewalls and base of excavation.

2. After the grid interval is calculated, it is recommended that a scaled grid overlay be made to superimpose on the area under consideration. Some specified point (usually the southwest corner) should be designated as the 0,0 coordinate. The grid can then be adjusted to maximize sampling coverage. Some grid adjustment may be necessary for unusually shaped areas.

STATISTICAL EVALUATION WASTE/TREATMENT CHARACTERIZATION SAMPLINGS

Following is a step by step description of the approach used to calculate confidence limits based on the analytical data derived from the preliminary samples.

1. Calculate a preliminary estimate of \bar{X}

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n}$$

where: n = number of measurements
 X = variable concentration
 X_i = individual measurements

2. Calculate a preliminary estimate of the variance (S^2) and the standard deviation (S). Standard deviation is a function of both sampling variability and measurement variability.

$$S^2 = \frac{\sum_{i=1}^n X_i^2 - \frac{(\sum_{i=1}^n X_i)^2}{n}}{n-1}$$

$$S = \sqrt{S^2}$$

3. Calculate the standard error of the mean (S_x). Standard error is inversely proportional to the square root of the number of samples (increasing n from 4 to 16 reduces S_x by 50%).

$$S_x = \frac{S}{\sqrt{n}}$$

4. Since the concern is only whether the upper limit of a confidence interval is below or above the regulatory threshold, the lower confidence limit (LCL) need not be considered. The upper confidence limit (UCL) can be calculated using the one-tailed (one-sided) t values with $n-1$ degrees of freedom derived from a table of the Student's t distribution. Where only small sized statistical samples are involved ($n < 30$), the normal or Gaussian distribution is not accurate, and the t distribution must be used.

5. The 95% UCL is calculated by using the following formula and substituting the values determined above plus the appropriate t value obtained from the t table.

$$UCL = \bar{X} + [t_{0.95(n-1)}]S_x$$

The term in brackets indicates a one-tailed t-test at n-1 degrees of freedom. See the t-distribution table in Attachment 2.

The UCL number resulting from this formula will indicate with a 95% probability that it is either above or below the regulatory threshold (RT) developed for the constituent being subjected to the test. If a compound does not have a specified RT, then the UCL is compared to whatever concentration is of concern (i.e., a clean up level, action level, etc). Other confidence levels can be used, based on the specific sampling situation.

If the preliminary data indicate that more samples are needed to make a hazard determination, the Lambda (λ) relationship should be used. A step by step approach to calculating the appropriate sample size follows:

1. The appropriate number of samples to be collected can be estimated by use of the Lambda (λ) relationship and then consulting a table of values and their corresponding sample size number.

$$\lambda = \frac{RT - \bar{X}}{S}$$

The lower the calculated value, the more samples are required to maintain a certain level of confidence. Also, as \bar{X} approaches RT, λ becomes smaller, and therefore a greater sample size is indicated for a certain level of confidence.

2. To obtain the appropriate sample size from the table of values, use the single sided value for α to test at the desired significance level (for 5%, $\alpha = 0.05$).
3. Randomly collect any additional samples that may be needed using the same grid and random numbers sequence as the first sampling. All field and laboratory procedures should be kept as consistent as possible to lower the amount of variability in the data.
4. Use all data values to calculate new \bar{X} , S, and S_x .

5. If the new $\bar{X} \geq RT$, then the contaminant is present at an unacceptable concentration and the study would be complete.
6. If $\bar{X} < RT$ and $\bar{X} > S^2$, calculate C (the criterion for determining if contamination is present at hazardous concentration). If $\bar{X} = S^2$ or $\bar{X} < S^2$, the data must be transformed prior to calculating C.

Using the new data, C is calculated by the formula:

$$C = \frac{RT - \bar{X}}{S_x}$$

7. Compare the calculated C value to the two-tailed t value for the level of significance desired. The two-tailed t-value is used because both the possibility that C is > t or that C is < t must be checked.

Use t0.95 and df (degrees of freedom) = n-1.

8. If $C > t$ value, the contaminant is present at unacceptable concentrations and the study would be over. If $C < t$ value, re-estimate the total number of additional samples to be collected by deriving a new λ . Use the newly calculated values of \bar{X} and S_x .
9. If this new number of samples is not more than 20% greater than the last set collected, there is little chance that additional samples would decrease S_x and result in the material being considered unacceptable. Therefore, the study would be complete.

EXAMPLE

CALCULATION OF CONFIDENCE LIMITS AND LAMDA CALCULATION

Problem 1: STATISTICAL SAMPLING

A metal plating factory has been discharging process wastewaters into a large nearby swampy area for several years. This swampy area drains into a small river. The discharged wastewaters are known to be contaminated with very low levels of cadmium and chromium (i.e., the levels in the wastewater are below the facilities NPDES permit limitations). However, it has been suspected that the sediments in this swampy area may contain high levels of cadmium and chromium. Three preliminary sediment samples were taken with a Ponar dredge and analyzed to determine whether or not these sediments were contaminated with hazardous levels of these two metals. In 40 CFR 261.24, it states that a waste is hazardous under the characteristic of EP toxicity if it contains cadmium at a level ≥ 1.0 mg/l or chromium at a level ≥ 5.0 mg/l. The analysis of the three preliminary samples indicated a mean cadmium concentration of 0.37 mg/l (3 samples at 0.25, 0.51, and 0.35 mg/l) and a mean chromium concentration of 4.66 mg/l (3 samples at 4.93, 4.21, and 4.84 mg/l). Based on this analytical data, the cadmium level is well below the regulatory threshold (RT), but the chromium level closely approaches its RT. Because large legal or monetary losses may be incurred if the sediments are declared hazardous, the analytical data must be sound and a high degree of confidence is necessary in any decision made.

QUESTIONS: Given the above scenario, answer the following questions and calculate the appropriate answers.

1. Based on the chromium data supplied

Calculate S^2 , S , S_x

Calculate the 95% UCL

With what degree of confidence can it be stated that the chromium concentration does not exceed the RT?

2. If more samples are deemed necessary, determine how many

Calculate the λ value

Calculate the appropriate number of additional samples using $\alpha = 0.05$ and $\beta = 0.05$

PROBLEM 1 ANSWER SHEET

Given three samples with chromium concentrations of 4.93, 4.21, and 4.84 mg/l and

$$\bar{X} = 4.66 \text{ mg/l}$$

(1a) Calculate S^2

$$S^2 = \frac{\sum_{i=1}^n X_i^2 - (\sum_{i=1}^n X_i)^2 / n}{n-1}$$

$$= \frac{4.93^2 + 4.21^2 + 4.84^2 - (4.93 + 4.21 + 4.84)^2 / 3}{2}$$

$$= 0.15$$

Calculate S

$$S = \sqrt{S^2} = \sqrt{0.15} = 0.39$$

Calculate S_x

$$S_x = \frac{S}{\sqrt{n}} = \frac{0.39}{\sqrt{3}} = 0.23$$

(1b) Calculate the 95% UCL

$$95\% \text{ UCL} = \bar{X} + [t_{0.95}(n-1)]S_x$$

$$= 4.66 + (2.920)(0.23)$$

$$= 5.33$$

(1c)

$$90\% \text{ UCL} = \bar{X} + [t_{0.90}(n-1)]S_x$$

$$= 4.66 + (1.886)(0.23)$$

$$= 5.09$$

$$80\% \text{ UCL} = \bar{X} + [t_{0.80}(n-1)]S_x$$

$$= 4.66 + (1.061)(0.23)$$

$$= 4.90$$

The preceding two calculations indicate that it can be stated with somewhere between 80% and 90% confidence that the chromium concentration does not exceed the RT. This degree of confidence may not be sufficient to meet the needs of the sampling plan. Therefore, more samples may need to be taken.

2a. Calculate the λ value

$$\lambda = \frac{RT - \bar{X}}{S} = \frac{5.0 - 4.66}{0.39} = 0.87$$

2b. Calculate the number of additional samples

Using Attachment 2, *Number of Observations for t Test of Mean*, page 36 of this Guidance Document, using a single-sided test with $\alpha=0.05$ and $\beta=0.05$, approximately 15 to 17 total samples need to be collected. Therefore, based on the three preliminary samples that were collected, an additional 13 samples need to be taken.

Cumulative t Distribution

		p							
		0.550	0.750	0.800	0.900	0.950	0.975	0.990	0.995
one-tailed	two-tailed	0.100	0.500	0.600	0.800	0.900	0.950	0.980	0.990
1		0.158	1.000	1.376	3.078	6.314	12.706	31.821	63.657
2		0.142	0.816	1.061	1.886	2.920	4.303	6.925	9.925
3		0.137	0.765	0.978	1.638	2.353	3.182	4.541	5.841
4		0.134	0.741	0.941	1.533	2.132	2.776	3.747	4.604
5		0.132	0.727	0.920	1.476	2.015	2.571	3.365	4.032
6		0.131	0.718	0.906	1.440	1.943	2.447	3.143	3.707
7		0.130	0.711	0.896	1.415	1.895	2.365	2.998	3.499
8		0.130	0.706	0.889	1.397	1.860	2.306	2.896	3.355
9		0.129	0.703	0.883	1.383	1.833	2.262	2.821	3.250
10		0.129	0.700	0.879	1.372	1.812	2.228	2.764	3.169
11		0.129	0.697	0.876	1.363	1.796	2.201	2.718	3.106
12		0.128	0.695	0.873	1.356	1.782	2.179	2.681	3.055
13		0.128	0.694	0.870	1.350	1.771	2.160	2.650	3.012
14		0.128	0.692	0.868	1.345	1.761	2.145	2.624	2.977
15		0.128	0.691	0.866	1.341	1.753	2.131	2.602	2.947
16		0.128	0.690	0.865	1.337	1.746	2.120	2.583	2.921
17		0.128	0.689	0.863	1.333	1.740	2.110	2.567	2.898
18		0.127	0.688	0.862	1.330	1.734	2.101	2.552	2.878
19		0.127	0.688	0.861	1.328	1.729	2.093	2.539	2.861
20		0.127	0.687	0.860	1.325	1.725	2.086	2.528	2.845
21		0.127	0.686	0.859	1.323	1.721	2.080	2.518	2.831
22		0.127	0.686	0.858	1.321	1.717	2.074	2.508	2.819
23		0.127	0.685	0.858	1.319	1.714	2.069	2.500	2.807
24		0.127	0.685	0.857	1.318	1.711	2.064	2.492	2.797
25		0.127	0.684	0.856	1.316	1.708	2.060	2.485	2.787
26		0.127	0.684	0.856	1.315	1.706	2.056	2.479	2.779
27		0.127	0.684	0.855	1.314	1.703	2.052	2.473	2.771
28		0.127	0.683	0.855	1.313	1.701	2.048	2.467	2.763
29		0.127	0.683	0.854	1.311	1.699	2.045	2.462	2.756
30		0.127	0.683	0.854	1.310	1.697	2.042	2.457	2.750
40		0.126	0.681	0.851	1.303	1.684	2.021	2.423	2.704
60		0.126	0.679	0.848	1.296	1.671	2.000	2.390	2.660
120		0.126	0.677	0.845	1.289	1.658	1.980	2.358	2.617
		0.126	0.674	0.842	1.282	1.645	1.960	2.326	2.576

NOTE: For one-tailed distributions $\alpha/2 = 1-p$
For two-tailed distributions $\alpha = 1-p$

NUMBER OF OBSERVATIONS FOR t TEST OF MEAN

Level for t Test

Single-sided Double-sided	$\alpha = 0.005$ -0.01					$\alpha = 0.01$ -0.02					$\alpha = 0.025$ -0.05					$\alpha = 0.05$ -0.1				
λ	$\beta = 0.01$	0.05	0.1	0.2	0.5	0.01	0.05	0.1	0.2	0.5	0.01	0.05	0.1	0.2	0.5	0.01	0.05	0.1	0.2	0.5
0.05																				
0.10																				
0.15																				
0.20										139.					99.					122.
0.25					110.					90.				128.	99.					70.
0.30				134.	78.				115.	63.			119.	90.	45.		122.	139.	101.	45.
0.35			125.	99.	58.			109.	85.	47.			88.	67.	34.		90.	97.	71.	32.
0.40		115.	97.	77.	45.		101.0	85.	66.	37.		109.	84.	68.	51.	101.	70.	55.	52.	24.
0.45		92.	77.	62.	37.	110.	81.0	68.	53.	30.	117.	84.	67.	54.	21.	80.	55.	44.	33.	15.
0.50	100.	75.	63.	51.	30.	90.	66.0	55.	43.	25.	76.	54.	44.	34.	18.	65.	45.	36.	27.	13.
0.55	83.	63.	53.	42.	26.	75.	55.0	46.	36.	21.	63.	45.	37.	28.	15.	54.	38.	30.	22.	11.
0.60	71.	53.	45.	36.	22.	63.	47.0	39.	31.	18.	53.	38.	32.	24.	13.	46.	32.	26.	19.	9.
0.65	61.	46.	39.	31.	20.	55.	41.0	34.	27.	16.	46.	33.	27.	21.	12.	39.	28.	22.	17.	8.
0.70	53.	40.	34.	28.	17.	47.	35.0	30.	24.	14.	40.	29.	24.	19.	10.	34.	24.	19.	15.	8.
0.75	47.	36.	30.	25.	16.	42.	31.0	27.	21.	13.	35.	26.	21.	16.	9.	30.	21.	17.	13.	7.
0.80	41.	32.	27.	22.	14.	37.	28.0	24.	19.	12.	31.	22.	19.	15.	9.	27.	19.	15.	12.	6.
0.85	37.	29.	24.	20.	13.	33.	25.0	21.	17.	11.	28.	21.	17.	13.	8.	24.	17.	14.	11.	6.
0.90	34.	26.	22.	18.	12.	29.	23.0	19.	16.	10.	25.	19.	16.	12.	7.	21.	15.	13.	10.	5.
0.95	31.	24.	20.	17.	11.	27.	21.0	18.	14.	9.	23.	17.	14.	11.	7.	19.	14.	11.	9.	5.
1.00	28.	22.	19.	16.	10.	25.	19.0	16.	13.	9.	21.	16.	13.	10.	6.	18.	13.	11.	8.	5.
1.1	24.	19.	16.	14.	9.	21.	16.0	14.	12.	8.	18.	13.	11.	9.	6.	15.	11.	9.	7.	
1.2	21.	16.	14.	12.	8.	18.	14.0	12.	10.	7.	15.	12.	10.	8.	5.	13.	10.	8.	6.	
1.3	18.	15.	13.	11.	8.	16.	13.0	11.	9.	6.	14.	10.	9.	7.		11.	8.	7.	6.	
1.4	16.	13.	12.	10.	8.	14.	11.0	10.	9.	6.	12.	9.	8.	7.		10.	8.	7.	5.	
1.5	15.	12.	11.	9.	7.	13.	10.0	9.	8.	6.	11.	8.	7.	6.		9.	7.	6.		
1.6	13.	11.	10.	8.	6.	12.	10.0	9.	7.	5.	10.	8.	7.	6.		8.	6.	6.		
1.7	12.	10.	9.	8.	6.	11.	9.0	8.	7.		9.	7.	6.	5.		8.	6.	5.		
1.8	12.	10.	9.	8.	6.	10.	8.0	7.	7.		8.	7.	6.			7.	6.			
1.9	11.	9.	8.	7.	6.	10.	8.0	7.	6.		8.	6.	6.			7.	5.			
2.0	10.	8.	8.	7.	5.	9.	7.0	7.	6.		7.	6.	5.			6.				
2.1	10.	8.	7.	7.		8.	7.0	6.	6.		7.	6.				6.				
2.2	9.	8.	7.	6.		8.	7.0	6.	5.		7.	6.				6.				
2.3	9.	7.	7.	6.		8.	6.0	6.			6.	5.				5.				
2.4	8.	7.	7.	6.		7.	6.0	6.			6.									
2.5	8.	7.	6.	6.		7.	6.0	6.			6.									
3.0	7.	6.	6.	5.		6.	5.0	5.			5.									
3.5	6.	5.	5.			5.														
4.0	6.																			

99% confidence

95% confidence

SAMPLING PROCESS STREAMS

Although sampling is generally thought to occur on a pile of material or over an area of treated soil, other schemes are possible. The most common instance is when the material is to be sampled at the point of generation. This is the preferred method, since it is most representative of the material under study. The lack of exposure to elements that might cause chemical degradation and/or leaching will result in material most indicative of actual conditions.

A sampling point along the material conveyor that can be fairly easily and safely reached should be chosen. It should be in an area where the entire belt can be accessed for sampling. Under this scenario, a temporal, rather than a spatial, approach needs to be used.

Time stratum should be established over the course of the process day. Ideally, the entire active time of the line should be included in the sampling scheme. Once time strata are chosen, the random numbers table can be used to establish sampling times. For a four hour period, a point somewhere on the table would be chosen and every number greater than 0 but less than 240 would be selected until the number of samples for that strata were obtained. The number would relate to time in minutes. This would be added to the starting time for that strata to determine the time of sampling.

If the time strata chosen are of unequal lengths, the number of samples chosen from any one strata should reflect the percentage contribution that strata makes to the time frame as a whole. For example, if for a 24 hour operating time, strata 1 is 4 hours and strata 2 is 8 hours, strata 2 should have twice as many samples as strata 1.

When the appropriate sampling time arrives, the material from the conveyor belt point that had been identified would be removed. This material should be well mixed and a subsample taken for inclusion in the jar for lab analysis. An example of the use of this protocol is attached.

RANDOM TIME WASTE SAMPLING EXAMPLE

	Sampling Point	Random Minute	Time
Stratum #1			
6:00 to 8:00 hours	1	28	6:28
	2	62	7:02
	3	99	7:39
	4	112	7:52
Stratum #2			
8:00 to 20:00 hours	1	11	8:11
	2	107	9:47
	3	156	10:36
	4	173	10:53
	5	296	12:56
	6	313	13:13
	7	398	14:38
	8	497	16:17
	9	555	17:15
	10	600	18:00
	11	637	18:37
	12	706	19:46
Stratum #3			
20:00 to 22:00 hours	1	13	20:13
	2	52	20:52
	3	88	21:28
	4	108	21:48
Stratum #4			
22:00 to 6:00 hours	1	48	22:48
	2	113	23:53
	3	153	24:33
	4	189	1:09
	5	227	1:47
	6	290	2:49
	7	314	3:14
	8	474	5:44

ATTACHMENT 3

TOLERANCE FACTORS (K)

TOLERANCE FACTORS (K) FOR ONE-SIDED NORMAL TOLERANCE
INTERVALS WITH PROBABILITY LEVEL (CONFIDENCE FACTOR)
Y = 0.95 AND COVERAGE P = 95%

<i>n</i>	<i>K</i>	<i>n</i>	<i>K</i>
3	7.655	75	1.972
4	5.145	100	1.924
5	4.202	125	1.891
6	3.707	150	1.868
7	3.399	175	1.850
8	3.188	200	1.836
9	3.031	225	1.824
10	2.911	250	1.814
11	2.815	275	1.806
12	2.736	300	1.799
13	2.670	325	1.792
14	2.614	350	1.787
15	2.566	375	1.782
16	2.523	400	1.777
17	2.486	425	1.773
18	2.453	450	1.769
19	2.423	475	1.766
20	2.396	500	1.763
21	2.371	525	1.760
22	2.350	550	1.757
23	2.329	575	1.754
24	2.309	600	1.752
25	2.292	625	1.750
30	2.220	650	1.748
35	2.166	675	1.746
40	2.126	700	1.744
45	2.092	725	1.742
50	2.065	750	1.740
55	2.036	775	1.739
60	2.017	800	1.737
65	2.000	825	0.736
70	1.986	850	1.734
		875	1.733
		900	1.732
		925	1.731
		950	1.729
		975	1.728
		1,000	1.727

SOURCE: FOR SAMPLE SIZES ≤ 50 : Lieberman, Gerald F. 1958. "Tables for One-sided Statistical Tolerance Limits." *Industrial Quality Control*. Vol. XIV, No. 10.

FOR SAMPLE SIZES ≥ 50 : K values were calculated from large sample approximation.

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ATTACHMENT 4

WASTE MANAGEMENT DIVISION'S CLEAN CLOSURE CERTIFICATION CHECKLIST

This checklist was developed to review RCRA clean closures. Due to direct reference to 40 CFR, Part 264, Subpart G, by Act 64, Rule 613; Act 64 closures should also be evaluated by this checklist.

Documentation supporting the owners/operators and the independent registered professional engineer's certification can be requested under 40 CFR, 264.115 and 265.115 (as of October 29, 1986). The owner/operator must submit at least four copies of certification documentation.

The checklist identifies items recommended to properly evaluate a closure certification. These items are not "absolutes." Other information or substitutions may be provided which technically justify and certify a "clean closure."

This checklist can be used for land disposal, storage, and treatment facilities. Several of the items would not be required for storage and/or treatment facilities where testing was minimal. Items 1 through 5 would be required for all closures. Items 6 through 11 would be optional for storage and/or treatment facilities, dependent on extent of testing required. Land disposal facilities would require all items listed.

1. Manifests (or some type of manifest/waste removal summary) of where and how much waste was shipped.
2. Certification statement is needed by the owner/operator AND an independent registered engineer. All independent registered professional engineer certificates must have an original stamp on at least one copy.
3. Summary of decontamination procedures (pressure wash, Steam clean, etc.) and how the resultant waste water was disposed.
4. Summary analysis (include conditions of haul roads, time table, soil and groundwater results, weather conditions, runoff controls, equipment decontamination, etc.).
5. Results of all tests used to determine clean closure (charts, tables, lab sheets).
6. Statistical comparisons on sampling results compared to cleanup criteria (this should include full computations on background and statistical analysis).
7. Sampling and analysis procedures (specify references).
8. Final depth and elevations of excavations of wastes and soils.

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1. Manifests (or some type of manifest/waste removal summary) of where and how much waste was shipped.
2. Certification statement is needed by the owner/operator AND an independent registered engineer. All independent registered professional engineer certificates must have an original stamp on at least one copy.
3. Summary of decontamination procedures (pressure wash, Steam clean, etc.) and how the resultant waste water was disposed.
4. Summary analysis (include conditions of haul roads, time table, soil and groundwater results, weather conditions, runoff controls, equipment decontamination, etc.).
5. Results of all tests used to determine clean closure (charts, tables, lab sheets).
6. Statistical comparisons on sampling results compared to cleanup criteria (this should include full computations on background and statistical analysis).
7. Sampling and analysis procedures (specify references).
8. Final depth and elevations of excavations of wastes and soils.

9. Properly labeled and easily identified sampling locations and grid stations (map) including background stations.
10. Groundwater data (and statistical evaluation) used to determine if groundwater degradation has occurred (usually four sets of replicate analysis compared to sampling event after closure activities). Monitor well construction details and sampling and analysis procedures may be required if documentation is not in the file.
11. Summary of final restoration of excavated area...
information on fill material used and/or future land use outline. If clean closure cannot be achieved (e.g., contaminated soils to water table and groundwater results show contamination). This summary item should be used to address the need for any post closure program and/or corrective action.
12. A copy of all field notes pertaining to these closure activities.
13. A copy of the approved closure plan and letter of closure plan approval.

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Detroit Coke Facility
Detroit, Michigan

Field Sampling Plan
RCRA Facility Investigation
USEPA ID Number MID099114704

February 1998

Project No. 97444GL

A MEMBER OF THE ENVIRONMENTAL RESOURCES MANAGEMENT GROUP

Environmental Resources Management
1630 Heritage Landing Drive, Suite 100
St. Charles, Missouri 63303



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6-1 Summary of Sampling and Analysis Program

1.0 INTRODUCTION

This Field Sampling Plan (FSP) describes the field methods which will be used to complete the RCRA Facility Investigation (RFI) at the Detroit Coke site in Detroit Michigan. This plan is to be used in conjunction with the RFI Project Management Plan (PMP) and RFI Quality Assurance Project Plan (QAPP). The PMP presents the technical approach, project management approach, and schedule for the RFI. The QAPP presents the laboratory methods, calibration procedures, and preventive maintenance procedures.

The background information for the site is presented in RCRA Facility Assessment (prepared by the U.S. EPA) and the Current Conditions Report included in this RFI Work Plan. The RFI sampling network, including technical approach, analytical parameters and sample locations, is presented in Section 4.0 of the PMP.

2.0 SUMMARY OF SAMPLING ACTIVITY

In summary, representative surface soil samples (0 to 2-foot) will be collected from the Tar Tank Area (SWMUs 11, 12, and 13), By-Products Containment Area (SWMUs 3, 5, 6, 19, and 21) and SWMU 15. The frequency of soil sample collection has been determined using the MDNR *Guidance Document for Verification of Soil Remediation* (April, 1994); which is included as Appendix A of the PMP. Actual soil sample locations have been estimated and may be modified based on field observations, with a bias toward obtaining samples of the most potentially impacted soils. Sampling depths have been determined based on the exposure pathway of concern, primarily direct human contact exposures. **It is important to note that soil sampling in the vicinity of the Tar Tank Area SWMUs will be conducted after removal of residual tar as described in Section 2.3 - Brownfields Redevelopment of the Site. The sampling will serve to characterize the underlying soil following completion of this interim remedial measure of source removal.**

Three monitoring wells will be installed in locations directly downgradient of the three SWMU areas mentioned above and SWMUs 1, 2, and 20, brought forward from the RA. **One additional monitoring well will be installed upgradient of the Tar Tank Area SWMUs.** The RFI will include installation of monitoring wells in the shallow water table unit beneath the site. These wells, together with **existing well MW-5** installed during the RA and 2-inch piezometers installed as part of the Expanded Hydrogeological Investigation (P-1S, P-2S, P-3S, P-4S, P-5S, and P-6D), will be sampled during the RFI **as the perimeter monitoring well network.**

Soil and ground water samples will be analyzed in the laboratory for the parameters included on the site target lists for soils and ground water, respectively.

3.0 *SAMPLE CUSTODY PROCEDURE*

3.1 *SAMPLE IDENTIFICATION SYSTEM*

Each sample collected for physical testing and chemical analysis will be assigned a unique number in order to identify the type and location of the sample. An example of the sample numbering scheme to be used at the Detroit Coke site is: **DC-MW01-9801-1**, where:

"DC" is the project identification code for the Detroit Coke site.

"MW01" is the sample matrix and location code. In this example, the sample is a ground water sample collected at monitoring well 01. Sample matrix codes which may be used are:

MW - Ground water, monitoring well samples;

SS - Soil samples.

"9801" is the year and quarter code. In this example, the sample was collected in the first quarter of 1998.

"1" indicates that this is the first sample collected during the specified year and quarter.

In the case of a duplicate or blank sample, the appropriate code will be added to the end of the sample number. The code for blank samples will be based on the type of blank collected. The codes are as follows:

DP - Duplicate samples;

EB - Equipment rinse blank samples;

TB - Trip blank samples.

For example, the sample number for a duplicate ground water sample collected at MW-01 during the first sampling in the first quarter of 1998 would be:

DC-MW01-9801-1-DP

3.2 *INITIATION OF FIELD CUSTODY PROCEDURES*

The sample packaging and shipment procedures summarized below will insure that the samples will arrive at the laboratory with the chain-of-custody intact. Examples of the chain-of-custody form, and other field and sampling activity forms are located in Appendix C of the QAPP.

3.2.1 *Field Sample Identification System*

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.
- All bottles will be tagged with sample numbers and locations. An example of a sample tag is located in Appendix C of the QAPP.
- Sample tags are to be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ball-point pen would not function in freezing weather.
- ERM will review all field activities to determine whether proper custody procedures were followed during the field work and decide if additional samples are required.

3.2.2 *Field Logbooks/Documentation*

Field logbooks will provide the means of recording the data collection activities performed. As such, entries will be described in as much detail as possible so that persons returning to the site may re-construct a particular situation without reliance upon memory.

Field logbooks will be bound books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control center when not in use. Each logbook will be identified by the project-specific document number.

The title page of each logbook will contain the following:

- person to whom the logbook is assigned;
- logbook number;
- project name;
- project start date; and
- end date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook. A guideline for taking field notes and records is given in Horizon Environmental's SOP in Appendix B.

Measurements made and samples collected will be recorded. All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the

information will be crossed out with a single strike mark, initialed and dated. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station shall be recorded. The identifying numbers of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in the QAPP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, and volume and number of containers. A sample identification number will be assigned prior to sample collection.

3.2.3 *Transfer of Custody and Shipment Procedures*

- Samples will be accompanied by a properly completed chain-of-custody form. The sample locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.
- Samples will be properly packaged for shipment and dispatched to TriMatrix Laboratory for analysis, with a separate signed chain-of-custody record enclosed in each sample cooler.
- All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment, and a copy will be retained by the sampler and returned to the ERM RFI Coordinator.
- If the samples are sent by common carrier, a bill of lading should be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside the sample cooler and the custody seal remains intact.

4.0 *SAMPLE CONTAINER PREPARATION, PRESERVATION, MAXIMUM HOLDING TIME, HANDLING, PACKAGING AND SHIPPING*

Requirements for sample containers (type and volume), preservation and holding times are summarized on Table 4-1. Sample packaging and shipment procedures are described in further detail in Horizon Environmental's field SOP in Appendix B of the QAPP.

5.0 DECONTAMINATION PROCEDURES

All equipment that comes into contact with potentially contaminated soil or ground water will be decontaminated after each use. The procedure that will be followed includes, but is not limited to:

- Drilling and soil sampling equipment (auger flights, split spoon samplers, sample tubes, knives or any other tool which comes into contact with a sample) will be washed in an alconox solution and/or steam-cleaned. A brush may be used to facilitate the process. Following washing, sampling equipment will be rinsed with distilled water.
- All well materials will be purchased pre-cleaned or will be steam cleaned prior to use.
- **All positive displacement pump components will be steam-cleaned prior to use.**
- All tubing used in the collection of ground water will be new for one time use only.

6.0 FIELD SAMPLING EQUIPMENT AND PROCEDURES

6.1 LOCATION AND ELEVATION SURVEY

At the start of the RFI field work, an **ERM** field technician will re-establish the site grid system by locating the 10 permanent bench marks placed on site during the RA. The bench marks will allow **ERM**'s field personnel to determine accurate sample locations and elevations as the RFI work is carried out.

6.2 SOIL SAMPLING PROCEDURES

During installation of monitoring wells, soil samples will be collected at 5-foot depth intervals using hollow stem auger (HSA) drilling and split spoon sampling techniques. Surface soil samples will be collected from the 0 to 2-foot depth interval using a hand auger.

All soil samples will be field screened for evidence of impact; both visually for staining and using a photoionization detector (PID) for total volatile organic compound vapors. The depth, soil type, blow counts (if applicable), and field screening results will be logged by the **ERM** field technician for each sampling interval. The sample location and elevation relative to permanent site bench marks will be determined by the **ERM** field technician.

As necessary any borings to be abandoned, will be backfilled with a cement /bentonite grout (if the boring has not penetrated a substantial clay unit capable of inhibiting vertical ground water movement, cuttings may be returned to the borehole from which they came). Handling of soil cuttings in this manner is consistent with MDNR guidance (MERA Operational Memorandum #7; *Disposition of Contaminated Excavated Soils*, October 21, 1991). The upper foot of borehole will be sealed with holeplug.

Soil cuttings from well borings will be containerized, labeled and secured on-site until proper disposal can be determined.

6.2.1 Sample Frequency and Selection of Samples for Laboratory Analysis

All soil samples will be field screened for evidence of impact (staining) and for volatile organic compound (VOCs) vapors. Soil samples collected during installation of monitoring wells will not be analyzed in the laboratory. All surface soil samples will be preserved for potential laboratory analysis at the time of collection. Field screening will be immediately after collection and preservation as practical.

VOC samples from soil will be preserved according to the new method 5035 in the latest release of SW-846. Soil samples collected for VOC analysis will be preserved for low level analysis using either field or laboratory preservation techniques. In the event laboratory preservation is preferred, then EnCore-type sampling devices will be used. Any soil samples collected for VOCs will be tested using analytical method 8260 which is consistent with MDEQ requirements. With respect to soils, samples for VOCs will be collected first, followed by SVOCs, then metals, as appropriate.

The one sample exhibiting the greatest potential for impact (based on field screening results) from each of the two large SWMU areas (Tar Tank Area and By-Products Containment Area) and the re-sample from BG-04 will be submitted to the laboratory for expedited analysis. The remaining constituents on the Appendix IX constituent list are not considered relevant given the materials and waste handled at the site. If any constituents from these three samples exceed the generic industrial cleanup criteria under Part 201 - Environmental Remediation of Act 451, they will be added to the Site Target List .

A representative number of the remaining samples (25% from each area) will be selected for laboratory analysis following receipt of results from the three expedited samples and any modification to the Site Target List. All samples will be collected from a specific SWMU area and field screened before the 25% of samples are selected for analysis. Those samples showing the greatest evidence of potential impact, based upon field screening, will be analyzed. The data quality completeness objective for soils will be based on the 25% of soil samples submitted for analysis rather than the total number of soil samples collected. This is based on the assumption that the 25% submitted for analysis have the greatest potential for impact and represent a biased "worst case" scenario for samples from the large SWMU areas.

If there are not enough potentially impacted soil samples to constitute 25% of the total samples, the difference will be made up with samples selected at random. All samples from SWMU 15 will be analyzed in the laboratory. The actual selection of samples will be made under the supervision of ERM's RFI Coordinator. These samples will be analyzed for the site target list parameters for soil, as amended. As specified in the PMP, soil samples from the Tar Tank Area SWMUs will be collected after removal of up to two feet of residual tar.

Ground water samples will be collected on a quarterly basis for one year from all wells installed during the RFI and from existing wells installed during the RA (MW-5) and existing 2-inch piezometers installed during the Expanded Hydrogeological Investigation (P-1S, P-2S, P-3S, P-4S, P-5S, and P-6D). Monitoring well MW-4 will also be sampled during the first round of perimeter monitoring to evaluate background along with MW-5. All ground water samples will be submitted to the laboratory and analyzed for the site target list parameters for ground water.

6.2.2 *Split-Spoon Sample Collection*

Pilot borings and borings for shallow well installation will be drilled using hollow stem auger drilling techniques. Soil samples will be collected using a 2-foot long, 2-inch diameter split-spoon sampler in accordance with ASTM Method D1586 and Horizon Environmental's SOP included in Appendix B of the QAPP. A 140-pound free-falling hammer will be used to drive the sampler 24 inches into the undisturbed soil ahead of the lead auger or open borehole.

6.2.3 *Surface Soil Sample Collection*

Shallow soil samples will be collected using a stainless steel hand auger. Samples will be collected by auguring a hole to a depth of 2 feet using a 5-inch diameter stainless steel auger head and collecting a soil sample for analysis from the 0 to 2 foot depth interval. A representative sample will be cut from the material recovered and split; one portion will be used for field screening and the other portion for immediate preservation and potential laboratory analysis. **As stated in Section 6.2.1, 25% of the samples from the Tar Tank Area SWMUs and the By-Products Containment Area SWMUs will be analyzed, using PID readings and visual characteristics to select the samples with the greatest potential for impact. All of the samples collected around SWMU 15 will be analyzed.** Backfilling of surface soil sample borings will be done with bentonite as needed.

6.2.4 *Field Screening*

Immediately upon collection, each soil sample will be split; one portion will be preserved for potential laboratory analysis and the other portion will be field screened visually for evidence of impact (staining) and for total VOCs vapors using a photoionization detector, in accordance with the SOP included in Appendix B of the QAPP.

6.3 *GROUND WATER SAMPLING PROCEDURES*

6.3.1 *Ground Water Monitoring Procedures*

6.3.1.1 *Shallow Water Table Monitoring Wells (Above the Clay Unit)*

Shallow water table monitoring wells will be constructed to straddle the water table. The wells will be constructed using 2-inch diameter galvanized steel riser pipe and 10-foot long continuous wire wrapped stainless steel screens installed through 4.25-inch ID or larger hollow stem augers as described in the SOP in Appendix B. All well materials will be purchased pre-cleaned or will be decontaminated using a high pressure steam wash.

A clean silica sand filter pack will be placed in the borehole annulus to a height of 1 foot above the top of the well screen. The remainder of the borehole annulus will be backfilled with cement/bentonite grout. A locking j-plug cap will be installed. The wells will be finished with either a cemented flush mount cover or steel procasing. The cement finish will be sloped away from the borehole to prevent surface water runoff from entering the well.

6.3.3.2 *Development*

Each new monitoring well will be developed by pumping and surging water through the well screen until relatively sediment free water is produced. The pH, temperature, and conductivity of ground water purged from monitoring wells constructed during the RFI will be measured and evaluated to demonstrate ground water stabilization prior to collection of samples for laboratory analysis. Development water will be discharged onto the ground surface next to the well unless free product is observed, in which case the development water will be containerized and disposed of in a proper manner with regard to state and federal regulations.

Soil cuttings will be containerized, labeled and secured on-site until proper disposal can be determined.

6.3.2 *Ground Water Sample Collection*

Prior to sampling, the monitoring wells and piezometers will be purged of a minimum of three well volumes. Well volume calculation will be done in accordance with the SOP in Appendix B of the QAPP with the well volume to include the well filter pack. Purging and sampling of the monitoring wells and piezometers will be done using a bladder or other type pump and dedicated Teflon tubing or Teflon bailers and new polypropylene rope. Ground water temperature, pH, conductivity, **dissolved oxygen, and turbidity** will be measured during the well purging procedure as a means of determining sufficient well recharge. A ground water sample will be collected after **removal of the three well volumes** and these parameters have stabilized to within 10% between two successive well volumes (minimum of three removed), or after the well has been bailed/pumped dry twice. Field measurements will be made in accordance with the field SOPs included in Appendix B of the QAPP.

Sample collection will be performed using a bladder pump with dedicated Teflon tubing and low-flow rates to minimize collection of suspended soil particles and other colloids. New latex gloves will be worn by field personnel during the sampling of each well.

Each well will be observed for the presence of free product and all ground water samples will be submitted to the laboratory for analysis.

6.3.3 *Ground Water Sampling Order*

To reduce the potential for cross contamination, upgradient wells will be sampled before wells installed downgradient of the SWMUs under investigation.

6.3.4 *Elevation Survey and Water Level Measurements*

ERM's field technician will locate each monitoring well relative to the site coordinate system using a tape measure and determine its top-of-casing and ground surface elevation to within 0.01-foot, relative to the permanent site bench marks established as described in Section 6.1.

Water level measurements will be made in all newly installed monitoring wells, all monitoring wells from the RA and all piezometers from the expanded hydrogeological investigation.

7.0 *PREVENTIVE MAINTENANCE PROCEDURES/SCHEDULE*

A PID will be used during the field investigation. Specific preventative maintenance procedures to be followed are those recommended by the manufacturer. This instrument will be checked and calibrated daily before use and as necessary thereafter. Backup instruments and equipment will be available on-site or within 1 day shipment to avoid delays in the field schedule.

TABLES

TABLE 4 - 1
SAMPLE CONTAINERS, PRESERVATIVES AND HOLDING TIMES

<i>Matrix</i>	<i>Parameter</i>	<i>Container</i>	<i>Preservation</i>	<i>Hold Times</i>	
				<u><i>Extraction</i></u>	<u><i>Analysis</i></u>
Water	Volatile	2 x 40 ml Glass	HCl to pH <2	---	14 days
	Organics	Septa Vial	Cool to 4°C		
Water	Semi-Volatile Organics	3 x 1 liter Amber Glass	Cool to 4°C	7 days	40 days
Soil	Volatile	125 ml Glass	Cool to 4°C	---	14 days
	Organics	Septa Vial			
Soil	Semi-Volatile Organics	500 ml Amber Glass	Cool to 4°C	14 days	40 days
Water	Metals	500 ml	pH <2	---	6 months
	(Except Hg)	plastic or glass	HNO ₃		
Water	Mercury	250 ml	pH <2	---	28 days
		plastic or glass	HNO ₃		
Soil	Metals	8 oz	---	---	6 months
	(Except Hg)	wide mouth			
Soil	Mercury	8 oz	---	---	28 days
		wide mouth			

All sample containers are purchased precleaned and certified as Level II by I-CHEM Inc.

TABLE 6-1

**Summary of Sampling and Analysis Program
RCRA Facility Investigation
Detroit Coke Facility
Detroit, Michigan**

Location	Matrix	Sample Interval	Field Parameters	Laboratory Analysis ¹	Investigative Samples	Duplicates	Blanks ²		MS/MSD	DQO
Tar Tank Area	Soil	0-2 Feet ⁴	Visual, PID Screening	---	35	NA	NA	NA	NA	I
Tar Tank Area	Soil	0-2 Feet ⁴	Visual, PID Screening	U.S. EPA Methods 8260 & 8270, Metals	1	NA	NA	NA	NA	I
Tar Tank Area	Soil	0-2 Feet ⁴	Visual, PID Screening	Site Target List for Soils, as amended ³	8	1/10	1/10	NA	1/20	IV
By-Products Area	Soil	0-2 Feet	Visual, PID Screening	---	22	NA	NA	NA	NA	I
By-Products Area	Soil	0-2 Feet	Visual, PID Screening	U.S. EPA Methods 8260 & 8270, Metals	1	NA	NA	NA	NA	I
By-Products Area	Soil	0-2 Feet	Visual, PID Screening	Site Target List for Soils, as amended ³	5	1/10	1/10	NA	1/20	IV
SWMU 15	Soil	0-2 Feet	Visual, PID Screening	Site Target List for Soils, as amended ³	5	1/10	1/10	NA	1/20	I/IV
Background (BG-04)	Soil	0-2 Feet	Visual, PID Screening	U.S. EPA Method 8260 & Metals	1	1/10	1/10	NA	1/20	I/IV
Background	Soil	0-2 Feet	Visual, PID Screening	Site Target List for Soils, as amended ³	7	1/10	1/10	NA	1/20	I/IV
Tar Tank Area SWMUs	GW	---	---	Site Target List for GW, as amended ³	2	1/10	1/10	1/shipment	1/20	IV
Site Perimeter	GW	---	---	Site Target List for GW, as amended ³	9 Qtrly ⁵	1/10	1/10	1/shipment	1/20	IV
Outfall Discharge	GW	---	---	Site Target List for GW, as amended ³	2	1/10	1/10	1/shipment	1/20	IV
Upgradient Ground Water	GW	---	---	Site Target List for GW, as amended ³	2 ⁶	1/10	1/10	1/shipment	1/20	IV

NA - not applicable

¹ See Table 7-3 of the QAPP for parameter list.

² Equipment Rinse and Trip Blanks are aqueous samples and will be analyzed for VOCs only.

³ Site Target Lists include aromatic hydrocarbons and base/neutral/acid semivolatile fractions including pyridine, amended to include additional parameters based on the analytical results of the background and worst case soils from the two large SWMUs. The 7 background samples will only be analyzed for the amended parameters.

⁴ Sample interval is 0-2 feet below excavated depth of product in the Tar Tank Area SWMUs.

⁵ The perimeter well network will be sampled quarterly for one year.

⁶ Includes MW-4 and MW-5, the latter of which is sampled as part of the perimeter monitoring network.

Detroit Coke Facility
Detroit, Michigan

Field Sampling Plan
RCRA Facility Investigation
USEPA ID Number MID099114704

February 1998

Project No. 97444GL

A MEMBER OF THE ENVIRONMENTAL RESOURCES MANAGEMENT GROUP

Environmental Resources Management
1630 Heritage Landing Drive, Suite 100
St. Charles, Missouri 63303



Detroit Coke Facility
Detroit, Michigan

Field Sampling Plan
RCRA Facility Investigation
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"DC" is the project identification code for the Detroit Coke site.

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MW - Ground water, monitoring well samples;

SS - Soil samples.

"9801" is the year and quarter code. In this example, the sample was collected in the first quarter of 1998.

"1" indicates that this is the first sample collected during the specified year and quarter.

In the case of a duplicate or blank sample, the appropriate code will be added to the end of the sample number. The code for blank samples will be based on the type of blank collected. The codes are as follows:

DP - Duplicate samples;

EB - Equipment rinse blank samples;

TB - Trip blank samples.

For example, the sample number for a duplicate ground water sample collected at MW-01 during the first sampling in the first quarter of 1998 would be:

DC-MW01-9801-1-DP

3.2 *INITIATION OF FIELD CUSTODY PROCEDURES*

The sample packaging and shipment procedures summarized below will insure that the samples will arrive at the laboratory with the chain-of-custody intact. Examples of the chain-of-custody form, and other field and sampling activity forms are located in Appendix C of the QAPP.

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- The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.
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Field logbooks will provide the means of recording the data collection activities performed. As such, entries will be described in as much detail as possible so that persons returning to the site may re-construct a particular situation without reliance upon memory.

Field logbooks will be bound books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control center when not in use. Each logbook will be identified by the project-specific document number.

The title page of each logbook will contain the following:

- person to whom the logbook is assigned;
- logbook number;
- project name;
- project start date; and
- end date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook. A guideline for taking field notes and records is given in Horizon Environmental's SOP in Appendix B.

Measurements made and samples collected will be recorded. All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the

information will be crossed out with a single strike mark, initialed and dated. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station shall be recorded. The identifying numbers of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in the QAPP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, and volume and number of containers. A sample identification number will be assigned prior to sample collection.

3.2.3 *Transfer of Custody and Shipment Procedures*

- Samples will be accompanied by a properly completed chain-of-custody form. The sample locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.
- Samples will be properly packaged for shipment and dispatched to TriMatrix Laboratory for analysis, with a separate signed chain-of-custody record enclosed in each sample cooler.
- All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment, and a copy will be retained by the sampler and returned to the ERM RFI Coordinator.
- If the samples are sent by common carrier, a bill of lading should be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside the sample cooler and the custody seal remains intact.

4.0 *SAMPLE CONTAINER PREPARATION, PRESERVATION, MAXIMUM HOLDING TIME, HANDLING, PACKAGING AND SHIPPING*

Requirements for sample containers (type and volume), preservation and holding times are summarized on Table 4-1. Sample packaging and shipment procedures are described in further detail in Horizon Environmental's field SOP in Appendix B of the QAPP.

5.0 DECONTAMINATION PROCEDURES

All equipment that comes into contact with potentially contaminated soil or ground water will be decontaminated after each use. The procedure that will be followed includes, but is not limited to:

- Drilling and soil sampling equipment (auger flights, split spoon samplers, sample tubes, knives or any other tool which comes into contact with a sample) will be washed in analconox solution and/or steam-cleaned. A brush may be used to facilitate the process. Following washing, sampling equipment will be rinsed with distilled water.
- All well materials will be purchased pre-cleaned or will be steam cleaned prior to use.
- All positive displacement pump components will be steam-cleaned prior to use.
- All tubing used in the collection of ground water will be new for one time use only.

6.0 FIELD SAMPLING EQUIPMENT AND PROCEDURES

6.1 LOCATION AND ELEVATION SURVEY

At the start of the RFI field work, an ERM field technician will re-establish the site grid system by locating the 10 permanent bench marks placed on site during the RA. The bench marks will allow ERM's field personnel to determine accurate sample locations and elevations as the RFI work is carried out.

6.2 SOIL SAMPLING PROCEDURES

During installation of monitoring wells, soil samples will be collected at 5-foot depth intervals using hollow stem auger (HSA) drilling and split spoon sampling techniques. Surface soil samples will be collected from the 0 to 2-foot depth interval using a hand auger.

All soil samples will be field screened for evidence of impact; both visually for staining and using a photoionization detector (PID) for total volatile organic compound vapors. The depth, soil type, blow counts (if applicable), and field screening results will be logged by the ERM field technician for each sampling interval. The sample location and elevation relative to permanent site bench marks will be determined by the ERM field technician.

As necessary any borings to be abandoned, will be backfilled with a cement /bentonite grout (if the boring has not penetrated a substantial clay unit capable of inhibiting vertical ground water movement, cuttings may be returned to the borehole from which they came). Handling of soil cuttings in this manner is consistent with MDNR guidance (MERA Operational Memorandum #7; *Disposition of Contaminated Excavated Soils*, October 21, 1991). The upper foot of borehole will be sealed with holeplug.

Soil cuttings from well borings will be containerized, labeled and secured on-site until proper disposal can be determined.

6.2.1 Sample Frequency and Selection of Samples for Laboratory Analysis

All soil samples will be field screened for evidence of impact (staining) and for volatile organic compound (VOCs) vapors. Soil samples collected during installation of monitoring wells will not be analyzed in the laboratory. All surface soil samples will be preserved for potential laboratory analysis at the time of collection. Field screening will be immediately after collection and preservation as practical.

VOC samples from soil will be preserved according to the new method 5035 in the latest release of SW-846. Soil samples collected for VOC analysis will be preserved for low level analysis using either field or laboratory preservation techniques. In the event laboratory preservation is preferred, then EnCore-type sampling devices will be used. Any soil samples collected for VOCs will be tested using analytical method 8260 which is consistent with MDEQ requirements. With respect to soils, samples for VOCs will be collected first, followed by SVOCs, then metals, as appropriate.

The one sample exhibiting the greatest potential for impact (based on field screening results) from each of the two large SWMU areas (Tar Tank Area and By-Products Containment Area) and the re-sample from BG-04 will be submitted to the laboratory for expedited analysis. The remaining constituents on the Appendix IX constituent list are not considered relevant given the materials and waste handled at the site. If any constituents from these three samples exceed the generic industrial cleanup criteria under Part 201 - Environmental Remediation of Act 451, they will be added to the Site Target List .

A representative number of the remaining samples (25% from each area) will be selected for laboratory analysis following receipt of results from the three expedited samples and any modification to the Site Target List. All samples will be collected from a specific SWMU area and field screened before the 25% of samples are selected for analysis. Those samples showing the greatest evidence of potential impact, based upon field screening, will be analyzed. The data quality completeness objective for soils will be based on the 25% of soil samples submitted for analysis rather than the total number of soil samples collected. This is based on the assumption that the 25% submitted for analysis have the greatest potential for impact and represent a biased "worst case" scenario for samples from the large SWMU areas.

If there are not enough potentially impacted soil samples to constitute 25% of the total samples, the difference will be made up with samples selected at random. All samples from SWMU 15 will be analyzed in the laboratory. The actual selection of samples will be made under the supervision of ERM's RFI Coordinator. These samples will be analyzed for the site target list parameters for soil, as amended. As specified in the PMP, soil samples from the Tar Tank Area SWMUs will be collected after removal of up to two feet of residual tar.

Ground water samples will be collected on a quarterly basis for one year from all wells installed during the RFI and from existing wells installed during the RA (MW-5) and existing 2-inch piezometers installed during the Expanded Hydrogeological Investigation (P-1S, P-2S, P-3S, P-4S, P-5S, and P-6D). Monitoring well MW-4 will also be sampled during the first round of perimeter monitoring to evaluate background along with MW-5. All ground water samples will be submitted to the laboratory and analyzed for the site target list parameters for ground water.

6.2.2 Split-Spoon Sample Collection

Pilot borings and borings for shallow well installation will be drilled using hollow stem auger drilling techniques. Soil samples will be collected using a 2-foot long, 2-inch diameter split-spoon sampler in accordance with ASTM Method D1586 and Horizon Environmental's SOP included in Appendix B of the QAPP. A 140-pound free-falling hammer will be used to drive the sampler 24 inches into the undisturbed soil ahead of the lead auger or open borehole.

6.2.3 Surface Soil Sample Collection

Shallow soil samples will be collected using a stainless steel hand auger. Samples will be collected by auguring a hole to a depth of 2 feet using a 5-inch diameter stainless steel auger head and collecting a soil sample for analysis from the 0 to 2 foot depth interval. A representative sample will be cut from the material recovered and split; one portion will be used for field screening and the other portion for immediate preservation and potential laboratory analysis. As stated in Section 6.2.1, 25% of the samples from the Tar Tank Area SWMUs and the By-Products Containment Area SWMUs will be analyzed, using PID readings and visual characteristics to select the samples with the greatest potential for impact. All of the samples collected around SWMU 15 will be analyzed. Backfilling of surface soil sample borings will be done with bentonite as needed.

6.2.4 Field Screening

Immediately upon collection, each soil sample will be split; one portion will be preserved for potential laboratory analysis and the other portion will be field screened visually for evidence of impact (staining) and for total VOCs vapors using a photoionization detector, in accordance with the SOP included in Appendix B of the QAPP.

6.3 GROUND WATER SAMPLING PROCEDURES

6.3.1 Ground Water Monitoring Procedures

6.3.1.1 Shallow Water Table Monitoring Wells (Above the Clay Unit)

Shallow water table monitoring wells will be constructed to straddle the water table. The wells will be constructed using 2-inch diameter galvanized steel riser pipe and 10-foot long continuous wire wrapped stainless steel screens installed through 4.25-inch ID or larger hollow stem augers as described in the SOP in Appendix B. All well materials will be purchased pre-cleaned or will be decontaminated using a high pressure steam wash.

A clean silica sand filter pack will be placed in the borehole annulus to a height of 1 foot above the top of the well screen. The remainder of the borehole annulus will be backfilled with cement/bentonite grout. A locking j-plug cap will be installed. The wells will be finished with either a cemented flush mount cover or steel procasing. The cement finish will be sloped away from the borehole to prevent surface water runoff from entering the well.

6.3.3.2 Development

Each new monitoring well will be developed by pumping and surging water through the well screen until relatively sediment free water is produced. The pH, temperature, and conductivity of ground water purged from monitoring wells constructed during the RFI will be measured and evaluated to demonstrate ground water stabilization prior to collection of samples for laboratory analysis. Development water will be discharged onto the ground surface next to the well unless free product is observed, in which case the development water will be containerized and disposed of in a proper manner with regard to state and federal regulations.

Soil cuttings will be containerized, labeled and secured on-site until proper disposal can be determined.

6.3.2 Ground Water Sample Collection

Prior to sampling, the monitoring wells and piezometers will be purged of a minimum of three well volumes. Well volume calculation will be done in accordance with the SOP in Appendix B of the QAPP with the well volume to include the well filter pack. Purging and sampling of the monitoring wells and piezometers will be done using a bladder or other type pump and dedicated Teflon tubing or Teflon bailers and new polypropylene rope. Ground water temperature, pH, conductivity, **dissolved oxygen, and turbidity** will be measured during the well purging procedure as a means of determining sufficient well recharge. A ground water sample will be collected after **removal of the three well volumes** and these parameters have stabilized to within 10% between two successive well volumes (minimum of three removed), or after the well has been bailed/pumped dry twice. Field measurements will be made in accordance with the field SOPs included in Appendix B of the QAPP.

Sample collection will be performed using a bladder pump with dedicated Teflon tubing and low-flow rates to minimize collection of suspended soil particles and other colloids. New latex gloves will be worn by field personnel during the sampling of each well.

Each well will be observed for the presence of free product and all ground water samples will be submitted to the laboratory for analysis.

6.3.3 *Ground Water Sampling Order*

To reduce the potential for cross contamination, upgradient wells will be sampled before wells installed downgradient of the SWMUs under investigation.

6.3.4 *Elevation Survey and Water Level Measurements*

ERM's field technician will locate each monitoring well relative to the site coordinate system using a tape measure and determine its top-of-casing and ground surface elevation to within 0.01-foot, relative to the permanent site bench marks established as described in Section 6.1.

Water level measurements will be made in all newly installed monitoring wells, all monitoring wells from the RA and all piezometers from the expanded hydrogeological investigation.

7.0 PREVENTIVE MAINTENANCE PROCEDURES/SCHEDULE

A PID will be used during the field investigation. Specific preventative maintenance procedures to be followed are those recommended by the manufacturer. This instrument will be checked and calibrated daily before use and as necessary thereafter. Backup instruments and equipment will be available on-site or within 1 day shipment to avoid delays in the field schedule.

TABLES

TABLE 4 - 1
SAMPLE CONTAINERS, PRESERVATIVES AND HOLDING TIMES

<i>Matrix</i>	<i>Parameter</i>	<i>Container</i>	<i>Preservation</i>	<i>Hold Times</i>	
				<u><i>Extraction</i></u>	<u><i>Analysis</i></u>
Water	Volatile Organics	2 x 40 ml Glass Septa Vial	HCl to pH <2 Cool to 4°C	---	14 days
Water	Semi-Volatile Organics	3 x 1 liter Amber Glass	Cool to 4°C	7 days	40 days
Soil	Volatile Organics	125 ml Glass Septa Vial	Cool to 4°C	---	14 days
Soil	Semi-Volatile Organics	500 ml Amber Glass	Cool to 4°C	14 days	40 days
Water	Metals (Except Hg)	500 ml plastic or glass	pH <2 HNO ₃	---	6 months
Water	Mercury	250 ml plastic or glass	pH <2 HNO ₃	---	28 days
Soil	Metals (Except Hg)	8 oz wide mouth	---	---	6 months
Soil	Mercury	8 oz wide mouth	---	---	28 days

All sample containers are purchased precleaned and certified as Level II by I-CHEM Inc.

Summary of Sampling and Analysis Program
RCRA Facility Investigation
Detroit Coke Facility
Detroit, Michigan

Location	Matrix	Sample Interval	Field Parameters	Laboratory Analysis ¹	Investigative Samples	Duplicates	Blanks ²		MS/MSD	DQO
Tar Tank Area	Soil	0-2 Feet ⁴	Visual, PID Screening	---	35	NA	NA	NA	NA	I
Tar Tank Area	Soil	0-2 Feet ⁴	Visual, PID Screening	U.S. EPA Methods 8260 & 8270, Metals	1	NA	NA	NA	NA	I
Tar Tank Area	Soil	0-2 Feet ⁴	Visual, PID Screening	Site Target List for Soils, as amended ³	8	1/10	1/10	NA	1/20	IV
By-Products Area	Soil	0-2 Feet	Visual, PID Screening	---	22	NA	NA	NA	NA	I
By-Products Area	Soil	0-2 Feet	Visual, PID Screening	U.S. EPA Methods 8260 & 8270, Metals	1	NA	NA	NA	NA	I
By-Products Area	Soil	0-2 Feet	Visual, PID Screening	Site Target List for Soils, as amended ³	5	1/10	1/10	NA	1/20	IV
SWMU 15	Soil	0-2 Feet	Visual, PID Screening	Site Target List for Soils, as amended ³	5	1/10	1/10	NA	1/20	I/IV
Background (BG-04)	Soil	0-2 Feet	Visual, PID Screening	U.S. EPA Method 8260 & Metals	1	1/10	1/10	NA	1/20	I/IV
Background	Soil	0-2 Feet	Visual, PID Screening	Site Target List for Soils, as amended ³	7	1/10	1/10	NA	1/20	I/IV
Tar Tank Area SWMUs	GW	---	---	Site Target List for GW, as amended ³	2	1/10	1/10	1/shipment	1/20	IV
Site Perimeter	GW	---	---	Site Target List for GW, as amended ³	9 Qtrly ⁵	1/10	1/10	1/shipment	1/20	IV
Outfall Discharge	GW	---	---	Site Target List for GW, as amended ³	2	1/10	1/10	1/shipment	1/20	IV
Upgradient Ground Water	GW	---	---	Site Target List for GW, as amended ³	2 ⁶	1/10	1/10	1/shipment	1/20	IV

NA - not applicable

¹ See Table 7-3 of the QAPP for parameter list.

² Equipment Rinse and Trip Blanks are aqueous samples and will be analyzed for VOCs only.

³ Site Target Lists include aromatic hydrocarbons and base/neutral/acid semivolatile fractions including pyridine, amended to include additional parameters based on the analytical results of the background and worst case soils from the two large SWMUs. The 7 background samples will only be analyzed for the amended parameters.

⁴ Sample interval is 0-2 feet below excavated depth of product in the Tar Tank Area SWMUs.

⁵ The perimeter well network will be sampled quarterly for one year.

⁶ Includes MW-4 and MW-5, the latter of which is sampled as part of the perimeter monitoring network.

Detroit Coke Facility
Detroit, Michigan

Data Management Plan
RCRA Facility Investigation
USEPA ID Number MID099114704

February 1998

Project No. 97444GL

A MEMBER OF THE ENVIRONMENTAL RESOURCES MANAGEMENT GROUP

Environmental Resources Management
1630 Heritage Landing Drive, Suite 100
St. Charles, Missouri 63303



Detroit Coke Facility
Detroit, Michigan

Data Management Plan
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1.0 INTRODUCTION

AlliedSignal Inc. will initiate this Data Management Plan (DMP) to document and track investigation data and results for the RCRA Facility Investigation (RFI) at the Detroit, Michigan facility. The data documentation materials, procedures and set up, the project file requirements, the project-related reporting procedures and documents and the format that will be used to present the raw data and conclusions of the investigation are described in this DMP.

2.0 DATA RECORDS

2.1 DATA COLLECTION RECORDS

Sampling data will be recorded as follows:

Sample and Field Measurement Code - Each sample and field measurement will be assigned an identification number which identifies the unique boring, well, or other location from which the sample or measurement was taken (e.g., DC-SB01-9601-1, or DC-MW01-9601-1). This code will be recorded on a laboratory chain-of-custody sheet for samples and in a field logbook for field measurements. The samples and measurements will be further identified by the date and depth (if applicable) of collection.

Sample and Field Measurement Location and Type - The location from which each sample or field measurement is collected will be shown on appropriate site or area maps with the corresponding sample or measurement code taken (e.g., DC-SB01-9601-1, or DC-MW01-9601-1). The type of sample or field measurement will be recorded on the laboratory chain-of-custody sheet for samples (e.g., soil, water, waste) and in a field logbook for field measurements (e.g., pH, water level).

Sample and Field Measurement Raw Data - Raw sample data (e.g., laboratory data sheets) will be maintained in the project file (see Section 2.2) and presented in reports in an appendix format. Raw field measurement data will be recorded in the field logbook which will also be maintained in the project file (see Section 2.2).

Laboratory Analysis ID Number - Each sample submitted for laboratory analysis will be assigned a unique identification number by the laboratory (e.g., D59987). This code will be recorded on the laboratory data sheet along with the analytical results for the corresponding sample. The samples and measurements will be further identified by the analytical laboratory which performed the laboratory analyses.

Analytical Results - For each sample collected for laboratory analysis, analytical results will be presented by the laboratory on summary data sheets which will identify the sample by sample code and laboratory identification number. The laboratory data sheets will be maintained in the project file (see Section 2.2) and presented in reports in an appendix format.

2.2 *PROJECT FILE REQUIREMENTS*

The project file will be considered the official record of the RFI. During the active phase of the investigation, the purpose of this file will be to present a thorough status report of completed tasks and work in progress on RFI. It will be the single source where the documentation of work from all aspects of the RFI is contained. The primary project file will be held by ERM.

Originals or copies of the following items will be maintained in the project file: contracts and agreements with subcontractors; work plans; incoming correspondence; outgoing correspondence; boring logs; daily field notes; laboratory reports; chain-of-custody forms; and final reports.

2.3 *DATA MANAGEMENT PROCEDURES*

Upon receipt of analytical data, any narrative provided by the analytical laboratory will be reviewed and qualifiers will be added to the data as specified. All laboratory data generated in conjunction with the RFI will be entered into a computer data management system. The database system will include relevant variables and customized data tables.

The procedure that will be used for entering data into the data management system is a single entry, multiple check procedure. All steps in the procedure will be documented on paper and stored in the project files. The multiple check procedure includes: at least one re-check on the screen by the data-entry person; manually checking for consistency with existing data in the system; and checking the printed data against the original laboratory data sheets.

3.0 *TABULAR DISPLAYS*

The original, unsorted (i.e., "raw") data will be presented in an appendix format. Each set of original data will have its own appendix (e.g., boring log sheets, well log sheets, laboratory data sheets). Analytical data will also be presented in tabular format for ease of review. Results for each monitored constituent will be included. Tables will be designed so the reader will be able to follow any relevant trends in the data. The tabular format will also serve as a data summary.

4.0 GRAPHICAL DISPLAYS

Graphical displays will be used to aid data interpretation. These figures will be used to visually characterize the existing conditions in the individual areas and/or over the entire site. The sampling area boundaries, sampling locations, levels of contamination at each location, and geographical extent of contamination will be displayed. Areas where more data are required, features affecting intramedia transport, and potential receptors will be indicated. The graphs will also show changes in concentration in relation to distance from the source, time, depth or other parameters.

Detroit Coke Facility
Detroit, Michigan

Data Management Plan
RCRA Facility Investigation
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Detroit Coke Facility
Detroit Michigan

Health and Safety Plan
RCRA Facility Investigation
USEPA ID Number MID099114704

February 1998

Project No. 97444GL

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Detroit Michigan

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St. Charles, Missouri 63303

SITE HEALTH & SAFETY PLAN WORKSHEET

INTRODUCTION

This document describes the health and safety guidelines and procedures developed for the field activities associated with a RCRA Facility Investigation - Release Assessment at the Detroit Coke facility in Detroit, Michigan. Soil and/or groundwater samples will be collected around solid waste management units (SWMUs) to determine the absence or presence of a release from the SWMUs to the environment. Coal fines and tar-like material may be encountered during drilling.

The guidelines and procedures contained herein are based on the best available information at the time of this plan's preparation. Specific requirements will be revised when and if new information is received or conditions change significantly from original indications. All work will be coordinated through the **ERM** Project Manager and will be performed in accordance with the provisions, guidelines, and procedures of this Site Health & Safety Plan (SHSP), and the requirements of OSHA's Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR 1910.120).

A. GENERAL INFORMATION

Client: AlliedSignal Inc.
Project Number: 97444GL
Site/Property Identification: Detroit Coke Facility
Address: 7819 West Jefferson
Detroit, Michigan

Plan Prepared by/Date: George Lynn/February 1, 1998
Plan Reviewed by/Date: Doug Burge/January 28, 1998

Type of Site (previous/current business or property use): Former coking plant.

Work Tasks (attach additional sheets, if necessary): _____

1) oversight of drilling contractor during installation of soil borings or use of Geoprobe/
hydraulic drive sampler

2) collection, screening with PID and preparation of soil samples from soil borings

3) installation of monitoring wells and collection of water samples

Expected Start Date and Duration of Project: 5/98 - 8/98

Expected Hours of Operation: 8:00 AM-5:00 PM (daylight)

Will Subcontractors Be Used (if yes, for which tasks)? Drilling

B. KEY PERSONNEL

Indicate name, company/agency affiliation, address and telephone number.

Project Manager:

George Lynn
Environmental Resources Management
1630 Heritage Landing Drive, Suite 100
St. Charles, Missouri 63303
(314) 928-0300

Site Health and Safety Officer:

Doug Burge
Environmental Resources Management
1630 Heritage Landing Drive, Suite 100
St. Charles, Missouri 63303
(314) 928-0300

Director of Corporate Health and Safety:

David Baron
Environmental Resources Management
704 North Deerpath Drive
Vernon Hills, Illinois 60061
(847) 680-6868

Health & Safety Representative:

Randy Cooper
Environmental Resources Management
1630 Heritage Landing Drive, Suite 100
St. Charles, Missouri 63303
(314) 918-0300
(314) 281-4833 (home)

Other Contacts (please indicate):

None

C. SITE CHARACTERIZATION

Hazardous Material Types: Liquid ☒ Solid ☒ Sludge ☐ Gas ☐

Hazardous Material Characterization: Corrosive ☐ Ignitable ☒ Radioactive ☐
Volatile ☒ Toxic ☒ Reactive ☐
Unknown ☐

Site History and Description: Detroit Coke and its predecessors operated a coking plant on the site from the early 1910's until 1991. The facility is currently used to store and load bulk coal, coke and limestone. Most of the buildings have been demolished.

Unusual Features (terrain, dike integrity, power lines, underground utilities): None

Have utilities been identified and clearly marked by appropriate utility personnel? No
Boring/well installation will occur well within the facility boundary. Facility manager will locate the few on-site utility corridors for field personnel and/or a utility search will be performed.

D. CHEMICAL DATA

Table D.1 - Known/Suspected Site Chemicals Present:

Chemical	Concentration*		
	Soil	Ground Water	Other
Benzene	40 mg/kg	38 ug/kg	
Ethylbenzene	1.7 mg/kg	Unknown	
Naphthalene	51 mg/kg	110 ug/kg	
Phenol	Unknown	Unknown	
PAHs	130 mg/kg	10 ug/kg	
Toluene	8.8 mg/kg	1.7 ug/kg	
Xylene	7.8 mg/kg	6.5 ug/kg	

*Site analytical data may be obtained from the Technical Manager or from the RCRA Facility Investigation Release Assessment Report, September, 1995.

SEE ATTACHED CHEMICAL SUMMARIES FOR EXPOSURE GUIDELINES.

BENZENE

Exposure to moderate to high levels of benzene causes CNS depression. Typical signs of benzene intoxication include drowsiness, dizziness, headache, vertigo, anorexia, visual disturbances, and delirium and may proceed to loss of consciousness. Moderate exposures can also cause eye and respiratory irritation. High levels of exposure can cause dyspnea and inebriation with euphoria and tinnitus (ringing in the ears) and can rapidly lead to a deep anesthesia. Without treatment, respiratory arrest rapidly ensues, often with muscular twitching and convulsions. Extremely high levels of benzene can also cause cardiac sensitization and arrhythmia.

The health effect of greatest concern associated with benzene is irreversible damage to the hematopoietic (blood forming) system. Chronic benzene exposure has been identified as causing leukemia and aplastic anemia. The bone marrow stops producing red blood cells. The immune system is also compromised due to reduced bone marrow function.

Benzene can be absorbed through the skin in significant amounts. Skin contact can cause moderate irritation, and, as with other organic solvents, can cause defatting and drying of the skin. This can lead to dermatitis and subsequent irritation. Cracking of the skin can result and lead to increased systemic uptake. Benzene that enters the body through the skin can then cause systemic effects similar to those seen from inhalation or ingestion.

First Aid Procedures:

- Inhalation - Remove person to fresh air. If breathing is difficult, seek immediate medical attention.
- Skin Contact - Flush skin with large amounts of water. If irritation persists, call a physician.
- Eye Contact - Irrigate with water for 15 minutes. If irritation persists, call a physician.
- Ingestion - Induce vomiting immediately as directed by medical personnel. Seek prompt medical attention.

OSHA: PEL = 1 ppm, STEL = 5 ppm, cancer hazard

ACGIH: TLV = 0.1 ppm, "skin" notation, confirmed human carcinogen (A1)

Other: NTP, IARC human carcinogen

Ionization Potential: 9.24eV

ETHYLBENZENE

Exposure to moderate to high levels of ethylbenzene causes CNS depression. Typical signs of ethylbenzene intoxication include drowsiness, dizziness, headache, vertigo, anorexia, visual disturbances, and delirium and may proceed to loss of consciousness. Moderate exposures can also cause eye and respiratory irritation. High levels of exposure can cause dyspnea and inebriation with euphoria and can rapidly lead to a deep anesthesia. Chronic overexposure can result in liver or kidney damage, and possible blood disorders.

Skin contact can cause moderate irritation, and, as with other organic solvents, can cause defatting and drying of the skin. This can lead to dermatitis and subsequent irritation. Ethylbenzene is not absorbed through the intact skin in significant amounts; however, cracking of the skin can result and lead to increased systemic uptake. Ethylbenzene that enters the body through the skin can then cause systemic effects similar to those seen from inhalation or ingestion.

First Aid Procedures:

- Inhalation - Remove person to fresh air. If breathing is difficult, seek immediate medical attention.
- Skin Contact - Flush skin with large amounts of water. If irritation persists, call a physician.
- Eye Contact - Irrigate with water for 15 minutes. If irritation persists, call a physician.
- Ingestion - Do not induce vomiting. Drink two glasses of water. Call a physician immediately.

OSHA: PEL = 100 ppm

ACGIH: TLV = 100 ppm, STEL = 125 ppm

Ionization Potential: 8.76eV

NAPHTHALENE

Naphthalene commonly occurs as white, crystalline flakes which has a strong coal tar odor. The flakes volatilize appreciable at room temperature. Inhalation may cause headache, loss of appetite and nausea. Optical neuritis, injuries to the cornea and liver damage have also been reported. Naphthalene vapors may also be irritating to the eyes.

First Aid Procedures:

- Inhalation - Remove person to fresh air. If breathing is difficult, seek immediate medical attention.
- Skin Contact - Flush skin with large amounts of water. If irritation persists, call a physician.
- Eye Contact - Irrigate with water for 15 minutes. If irritation persists, call a physician.
- Ingestion - Induce vomiting immediately as directed by medical personnel. Seek immediate medical attention.

OSHA: PEL = 10 ppm

ACGIH: TLV = 10 ppm, STEL = 15 ppm

Ionization Potential: 8.12eV

PHENOL

The health effects from phenol exposure are characterized by potential acute illness. It is readily absorbed through the skin which represents the primary route of entry. Fatalities have occurred in workers after gross skin contact. Phenol is also toxic upon ingestion. An oral dose of 1 gram may be fatal to man. Ingestion causes intense burning of the mouth and throat followed by abdominal pain.

Chronic phenol poisoning is characterized by digestive disturbances, nervous disorders, and possible skin eruptions. Extensive damage to the liver and kidneys follows and is usually fatal.

First Aid Procedures:

- Inhalation - Remove person to fresh air. If breathing is difficult, seek immediate medical attention.
- Skin Contact - Flush skin with large amounts of water for at least 15 minutes. Seek immediate medical attention.
- Eye Contact - Irrigate with water for 15 minutes. Seek immediate medical attention.
- Ingestion - Induce vomiting immediately as directed by medical personnel. Seek immediate medical attention.

OSHA: PEL = 5 ppm, "skin" notation
ACGIH: TLV = 5 ppm, "skin" notation
Ionization Potential: 8.50eV

POLYARYLHYDROCARBONS (PAHs)

Acenaphthene, Acenaphthylene, Anthracene, Benzo(a)Anthracene, Benzo(a)Pyrene, Benzo(b)Fluoranthene, Benzo(g,h,i)Perylene, Benzo(k)Fluoranthene, Chrysene, Dibenz(a,h)Anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)Pyrene, Naphthalene, Phenanthrene, Pyrene, and derivatives.

The PAHs are characterized by their polycyclic ring structures and varying molecular weights. Low molecular weight PAHs (anthracene, fluorene, naphthalene, phenanthrene) are generally considered to present less of a health risk than those of greater molecular weight (benzo(a)anthracene, chrysene, benzo(a)pyrene, benzo(e)pyrene). Many of these higher molecular weight compounds and their derivatives are known to be carcinogenic.

Human exposures usually involve complex mixtures, rather than a single PAH compound. Typical exposures occur as polluted air due to cigarette smoke, vehicle exhaust, and domestic energy emissions.

A majority of PAH studies have involved benzo(a)pyrene (BAP) due to its wide distribution and high biological activity. Results have indicated BAP to be a positive animal and suspect human carcinogen. It has also been shown to be both teratogenic and mutagenic in laboratory animals.

First Aid Procedures:

- Inhalation - Remove person to fresh air. If breathing is difficult, seek immediate medical attention.
- Skin Contact - Flush skin with large amounts of water. If irritation persists, call a physician.
- Eye Contact - Irrigate with water for 15 minutes. Seek immediate medical attention.
- Ingestion - Seek prompt medical attention. Induce vomiting only at the instruction of a physician.

No specific workplace standards have been established for PAHs. It is generally accepted to use the coal tar pitch volatiles-benzene soluble fraction standard of 0.2 mg/m³ when evaluating air samples. It is reported that approximately 10% of coal tar pitch volatiles consist of polycyclic hydrocarbons. The ACGIH recognizes coal tar pitch volatiles as a confirmed human carcinogen (A1 designation).

TOLUENE

Exposure to moderate to high levels of toluene causes CNS depression. Typical signs of toluene intoxication include drowsiness, dizziness, headache, vertigo, anorexia, visual disturbances, and delirium and may proceed to loss of consciousness. Moderate exposures can also cause eye and respiratory irritation. High levels of exposure can cause dyspnea and inebriation with euphoria and can rapidly lead to a deep anesthesia. Without treatment, respiratory arrest rapidly ensues, often with muscular twitching and convulsions. Extremely high levels of toluene can also cause cardiac sensitization and arrhythmia.

Skin contact can cause moderate irritation, and, as with other organic solvents, can cause defatting and drying of the skin. This can lead to dermatitis and subsequent irritation. Toluene is not absorbed through the intact skin in significant amounts; however, cracking of the skin can result and lead to increased systemic uptake. Toluene that enters the body through the skin can then cause systemic effects similar to those seen from inhalation or ingestion.

First Aid Procedures:

- Inhalation - Remove person to fresh air. If breathing is difficult, seek immediate medical attention.
- Skin Contact - Flush skin with large amounts of water. If irritation persists, call a physician.
- Eye Contact - Irrigate with water for 15 minutes. If irritation persists, call a physician.
- Ingestion - Do not induce vomiting. Drink two glasses of water. Call a physician immediately.

OSHA: PEL = 200 ppm, 300 ppm ceiling, 500 ppm maximum peak

ACGIH: TLV = 50 ppm, "skin" notation

Ionization Potential: 8.82eV

XYLENE

Inhalation of xylene in high concentrations can cause a flushing or reddening of the face, a feeling of increased body heat, and CNS excitation followed by depression, confusion, and coma. Other symptoms of overexposure include disturbed vision, dizziness, headache, tremors, salivation, cardiac stress, impaired memory, flatulence, loss of appetite, extreme fatigue, and respiratory distress. Inhalation of extremely high concentrations has caused sudden deaths, believed to be due to cardiac sensitization to epinephrine and resultant ventricular fibrillation and respiratory arrest.

Other potential health effects of acute high concentration exposures have included severe respiratory irritation, lung congestion, pulmonary edema, g.i. tract disturbances, and liver, kidney, and nervous system damage.

Xylene can be absorbed through the skin in significant amounts. Skin contact does not cause significant irritation, but, as with other organic solvents, can cause defatting and drying of the skin. This can lead to dermatitis and subsequent irritation. Cracking of the skin can result and lead to increased systemic uptake. Xylene that enters the body through the skin can then cause systemic effects similar to those seen from inhalation or ingestion.

First Aid Procedures:

- Inhalation - Remove person to fresh air. If breathing is difficult, seek immediate medical attention.
- Skin Contact - Flush skin with large amounts of water. If irritation persists, call a physician.
- Eye Contact - Irrigate with water for 15 minutes. If irritation persists, call a physician.
- Ingestion - Seek prompt medical attention. Induce vomiting only at the instruction of a physician.

OSHA: PEL = 100 ppm

ACGIH: TLV = 100 ppm, STEL = 150 ppm

Ionization Potential: 8.56eV

E. SITE WORK PLAN SPECIFICATIONS

Identify Site Security (perimeter fences, guard shacks, etc.): Perimeter fence and security guards during the day. Site may not be secure after hours.

Are Work Zones Established (if yes, please identify)? NA

Anticipated Level of Personal Protective Equipment Required:

Level D ☒ [X]

Level C ☐ []

Level B ☐ []

If sustained breathing zone PID readings of 5 ppm or greater, don a full-face or half-face respirator with organic vapor cartridges

Personal Protective Equipment (PPE) Specifications: Hard hat; safety glasses with side shields; steel toe/steel shank footwear; nitrile or other outer glove over 4-H inner glove

Will Level B PPE Be Available at the Site? No

Table E.1 - Monitoring Requirements:

Instrument	Location/Zone to be Monitored (e.g. Breathing Zone, Ambient Air)	Frequency
OVM/HnU	Breathing zone	During all drilling activities and when screening soil samples

Identify Anticipated Safe Work Procedures Used On Site:

Confined Space Entry* ☐ []

Hot Work* ☐ []

Excavation/Trenching ☐ []

Drill Rig Operation ☒ [X]

Other (please identify) ☐ []

***permit required**

Calibration Record: Per manufacturer's recommendations

Decontamination Procedures: Discard disposable PPE. Soap/Alconox wash/rinse non-disposable PPE

Identify Special Client Work Procedures: NA

Is Site Map Attached? Site location map is attached

Table E.2 - Project Team:

Team Member	Responsibility	Training Required	Fit Tested
George Lynn	Project manager		
Doug Burge	Field activity oversight or office contact	HAZWOPER 40 hr and up-to-date 8 hr	Yes
Doug Burge	Site H&S officer	Same as above	Yes
Drilling contractor	Operate drilling rig	Same as above	

F. EMERGENCY RESPONSE

On-Site Resources (if yes, please indicate location or source):

Water Supply ☐
Telephone ☒ Field technician's truck
Radio ☐
Other ☐ _____

Emergency Contacts (location, telephone number):

Police Department: 911

Hospital:

Oakwood Downriver Medical Center

25750 West Outer Drive

Lincoln Park, Michigan

382-6000

or

Oakwood Hospital

18101 Oakwood Boulevard

Dearborn, Michigan

593-7000

Ambulance:

911

Fire Department:

911

Poison Control Center:

745-5711 or 1-800-462-6642

ERM Environmental Health & Safety:

Randy Cooper

Environmental Resources Management

1630 Heritage Landing Drive, Suite 100

St. Charles, Missouri 63303

(314) 928-0300

(314) 281-4833 (home)

Dave Baron

Environmental Resources Management

704 North Deerpath Drive

Vernon Hills, Illinois 60061

(847) 680-6868

Other (please indicate):

Emergency Response Will be Carried Out By the Responding Emergency Service Only.

Hospital Route:

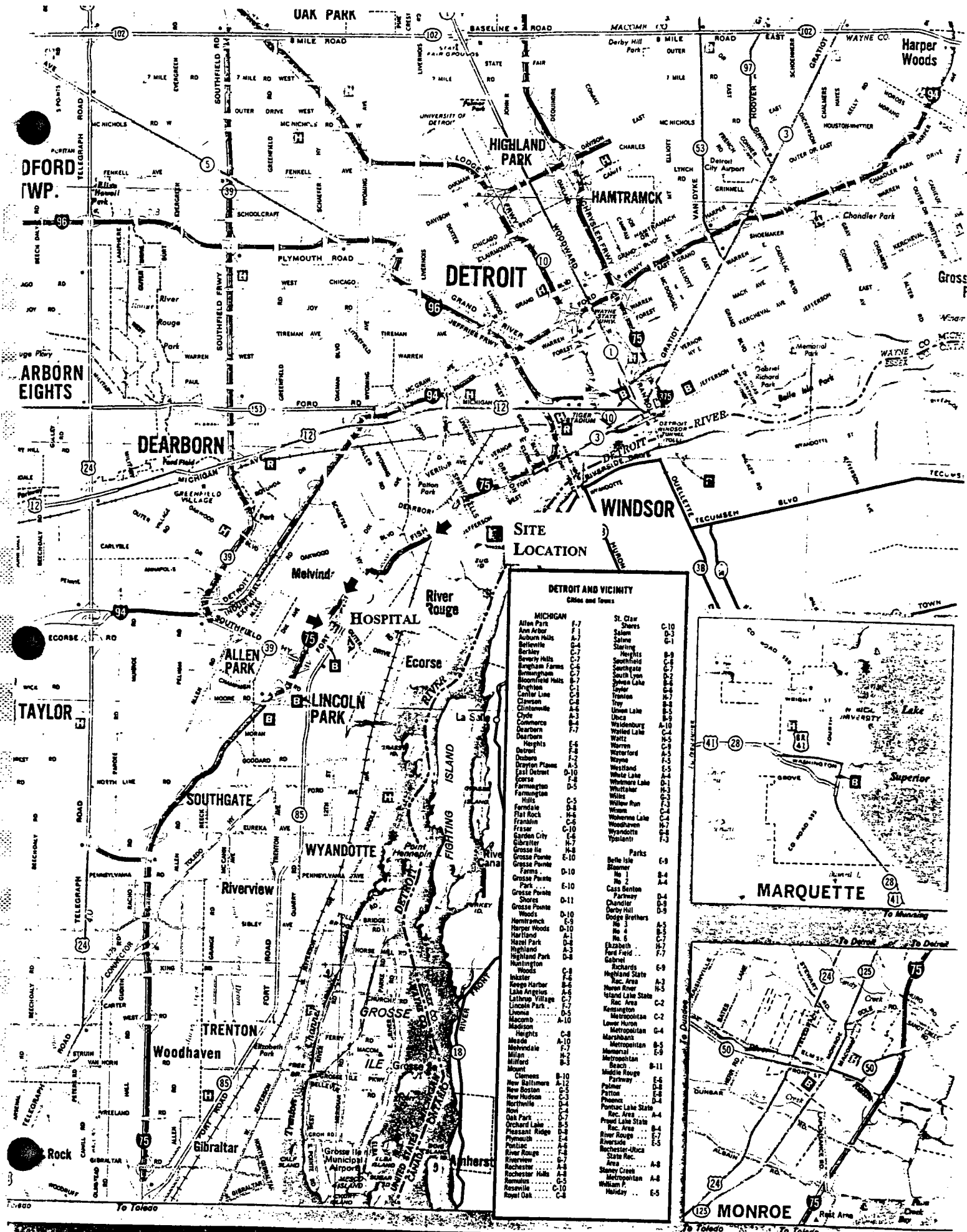
- ***Oakwood Medical Center*** - West Jefferson to West End Road. I-75 south to Exit 42 (Outer Drive). Medical Center will be on the left side of Outer Drive when you exit the expressway.
- ***Oakwood Hospital*** - West Jefferson to West End Road. Take West Fort Street west. West Fort Street will turn into Oakwood Boulevard. Proceed west under I-94 expressway & M-39. Hospital is 1/2 mile west of M-39 interchange.

Is Hospital Route Map Attached? Yes

SHSP Review Acknowledgment Form

I have been informed, understand and will abide by the procedures set forth in the Site Health and Safety Plan and any Amendments for the Phase II Perimeter Investigation at the Detroit Coke Corporation facility site in Detroit, Michigan.

[illegible]



Detroit Coke Facility
Detroit, Michigan

Quality Assurance Project Plan
RCRA Facility Investigation
USEPA ID Number MID099114704

February 1998

Project No. 97444GL

A MEMBER OF THE ENVIRONMENTAL RESOURCES MANAGEMENT GROUP

Environmental Resources Management
1630 Heritage Landing Drive, Suite 100
St. Charles, Missouri 63303



Detroit Coke Facility
Detroit, Michigan

Quality Assurance Project Plan
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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

The United States Protection Agency (U.S. EPA) requires that all environmental monitoring and measurement efforts mandated or supported by the U.S. EPA participate in a centrally managed quality assurance (QA) program.

Any party generating data under this program has the responsibility to implement minimum procedures to assure that the precision, accuracy, completeness, and representativeness of its data are known and documented. To ensure the responsibility is met uniformly, each party must prepare a written QA Project Plan (QAPP) covering each project it is to perform.

This QAPP presents the organization, objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities associated with the RCRA Facility Investigation (RFI) scope of work for the Detroit Coke site. This QAPP also describes the specific protocols which will be followed for sampling, sample handling and storage, chain-of-custody, and laboratory analysis. All QA/QC procedures will be conducted in accordance with applicable professional technical standards, U.S. EPA requirements and guidelines, and specific project goals and requirements.

This QAPP has been prepared in accordance with the U.S. EPA guidance manual entitled, Region 5 Model RCRA Quality Assurance Project Plan (May, 1993). It is to be read in conjunction with the Project Management Plan (PMP), the Field Sampling Plan (FSP), and the Data Management Plan (DMP).

1.1.1 Overall Project Objectives

Condition D of the Detroit Coke Corporation's Underground Injection Control (UIC) permit (number M1-163-1W-0004) identifies 13 SWMUs (solid waste management units) requiring possible investigation and corrective actions under the U.S. EPA's RCRA Corrective Action Program. In the RCRA Corrective Action framework, the purpose of a RCRA Facility Investigation (RFI) is to evaluate thoroughly the nature and extent of the release of hazardous wastes or constituents and to gather screening data to support the corrective measures study.

Of the 13 SWMUs identified by U.S. EPA at the Detroit Coke facility, 4 have been the subject of a Release Assessment (RA). Detroit Coke elected to conduct an RA at SWMUs 1, 2, 18 and 20, based on historical records and known housekeeping practices which suggest that a release has not occurred at these units. A report¹

¹ RCRA Facility Investigation Release Assessment, September, 1995

summarizing the findings of the RA was approved by U.S. EPA in a letter dated December 13, 1995. Of the 4 SWMUs investigated during the RA, it was recommended that SWMUs 1, 2, and 20 be carried forward to the RFI phase of the corrective action program and SWMU 18 be dropped from further investigation during the RFI.

The remaining SWMUs have been grouped based on proximity and the materials handled. SWMUs 3, 5, 6, 19, and 21 have been grouped into the "By-Products Containment Area" and SWMUs 11, 12, and 13 have been grouped into the "Tar Tank Area". SWMU 15 will remain separate. The By-Products Containment Area, the Tar Tank Area, and SWMU 15 will be investigated as part of the scope of the RFI described herein. Additionally, SWMUs 1, 2, and 20 will be further investigated as recommended in the RA report.

In addition to the RA an Expanded Hydrogeological Investigation of the Detroit Coke Facility was conducted concurrently with the RA to provide greater understanding of the hydrogeology beneath the facility and the relationships between the ground water flow regimes and the two rivers which form the southeast and southwest perimeters of the site.

Based on the results of the two investigations mentioned above, a perimeter approach to the RFI ground water investigation has been recommended for this site for the following reasons:

- The remaining SWMUs are in very close proximity to one another making the physical extent of an individual SWMU coincident with the adjacent SWMUs for all practical purposes;
- The hazardous constituents managed at the various SWMUs are similar to the degree that this similarity, and the proximity of the SWMUs to one another, precludes definitive determination of the source of a release on a SWMU specific basis;
- The facility, and the area in general, have been industrialized since the turn of the century enhancing the potential commingling of released constituents further limiting the potential to assign a release to a specific SWMU;
- Soils at the site exhibit ubiquitous nuisance level impact from nearly a century of air deposition of coal fines and other industrial byproducts and consequently site wide exposure controls constitute the most reasonable and cost effective corrective action for this medium;
- Ground water was not found to be within an aquifer used for potable supplies and or industrial uses;
- Ground water beneath the site was found to be limited to 2 thin saturated zones in the upper 50 feet of sediments underlying the site;

- The boundaries of the saturated zones in the downgradient direction are the Detroit and Rouge Rivers (in the horizontal dimension and are likely the discharge point for all ground water underlying the site) and in the vertical dimension the saturated zone is underlain by a thick interval of low permeability clay occurring anywhere from 10 feet below the ground surface distal from the rivers to 50 feet below the ground surface in proximity to the rivers;
- All SWMUs and remaining physical structures at the site are currently in the demolition process limiting their potential as an ongoing source; and
- Following corrective action to control exposures to soils at the site the only remaining reasonable and relevant exposure pathway for contaminants is via ground water discharging into one or the other of the adjacent rivers. **Other possible exposure pathways, such as fugitive dust emissions and release to surface waters by runoff, should be eliminated through this corrective action, along with the interim remedial measures and future redevelopment described in Section 2.3 of the PMP.**

Consequently, in addition to defining potential direct human contact exposures to soil, the primary focus of the RFI will be to define ground water flow conditions at the perimeter of the site where there may be a potential for uncontrolled exposures to occur.

1.1.2 Project Status/Phase

As mentioned previously, subsequent to U.S. EPA's RCRA Facility Assessment (RFA), the Corrective Action process at the Detroit Coke facility was initiated by conducting a RA involving four SWMUs, while the remainder of the SWMUs (9) were to move forward to the RFI without preliminary investigation. The RA was completed in 1995 resulting in the removal of one of the four SWMUs involved in the RA, SWMU 18. The remainder, SWMUs 1, 2, and 20, will move forward to the RFI along with the nine SWMUs previously defined by the RFA.

Currently, the facility is moving forward with the RFI scope of work which incorporates the three SWMUs which were moved forward from the RA and the remaining nine SWMUs defined by the RFA. A complete description of the scope of the RFI, as currently planned, is presented in the Project Management Plan. Based upon the results of the scope described therein, it may become necessary to incorporate additional phases of investigation within the RFI framework of the Corrective Action Program being implemented at the site. However, to the extent possible, additional phases will be preempted by preparing addenda to the current RFI scope of work, as necessary, and conducting such work in an ongoing progression. This strategy of preparing and implementing addenda is intended to minimize both the cost and duration of the RFI phase of work.

1.1.3 QAPP Preparation Guidelines

The QAPP covers all RFI data collection in order that the sampling performed in each media will meet the desired data quality objectives (DQO). This will ensure that all the data collected as part of the RFI will be useful for the purposes intended. This QAPP has been prepared in accordance with the *Region 5 Model QAPP* (May 1993), provided by the U.S. EPA RCRA RA Project Coordinator.

1.2 SITE/FACILITY DESCRIPTION

1.2.1 Location

The Detroit Coke facility is located at 7819 West Jefferson Avenue in Detroit, Michigan (Wayne County, T2S, R11E, Private Claim 67). The location of the facility is shown of Figure 1-1.

1.2.2 Site/Facility Size and Borders

The Detroit Coke facility occupies approximately 60 acres. The facility is located at the north side of the northern confluence of the Rouge and Detroit Rivers. The property immediately surrounding the facility is industrial; however, the facility is located approximately 1,000 feet southeast of a residential neighborhood; approximately 0.5 miles southeast of McMillan School; 0.5 miles southeast of Good Hope School; approximately 0.5 miles south of Cary School; 1.25 miles west of Prince Road Park, and about 1.75 miles west of a hospital near Sandwich, Ontario.

1.2.3 Natural and Manmade Features

The Detroit Coke facility is located in a heavily industrialized area along the Detroit and Rouge Rivers, as shown in Figure 1-1. Both rivers are used for transport of bulk materials by barge as well as recreational boating and fishing.

1.2.4 Topography

Site topography is shown in Figure 1-1. The site is relatively flat with an elevation of around 590 feet above mean sea level. Ground surface at the site slopes gently toward the Detroit River to the east and the Rouge River to the south. Surface elevations range from about 590 feet MSL in the north to about 580 feet MSL adjacent to the rivers.

1.2.5 Local Geology and Hydrogeology

1.2.5.1 Soil and Geology

The site is located within a glacial lake plain once occupied by ancestral Lake Erie. The surficial geology of the site consists of fill material underlain by approximately 100 feet of glacial deposits including alluvial deposits, lacustrine and deltaic sand, lacustrine clay, and lacustrine and deltaic loam. These sediments were deposited during the Wisconsin stage of the Pleistocene glaciation, and are related to the advance and withdrawal of the Erie-Huron ice lobe. Bedrock formations immediately underlying the glacial deposits consist of approximately 4,000 feet of Paleozoic sedimentary deposits which dip northwest at approximately 30 feet/mile.

1.2.5.2 Ground Water

The uppermost permeable unit at the site is the surficial fill material of approximately 10-15 feet in thickness. Perched ground water is present at depths as shallow as 3 feet within this unit, but more typically exists at depths of 10 to 15 feet. Alluvial deposits consisting primarily of silt and clay; along with glacial lake plain deposits of clay and varying amounts of sand exist beneath the fill layer over most of the site. Ground water in varying quantities occurs within these units. The regional ground water flow is to the south and southeast toward the Detroit and Rouge Rivers.

Public drinking water is obtained primarily from surface water sources and supplied by the Detroit Metro Water Department. The surface water sources include Lake St. Claire, Detroit River, Clinton River, River Rouge, Huron River and inland lakes. There are some private wells in the area that obtain water from the glacial deposits, either the Berea Sandstone or the Sylvania Sandstone Formations.

1.3 SITE/FACILITY HISTORY

1.3.1 General History

Detroit Coke was a coking facility which also produced coal tar and coke oven gas byproducts. The coke was supplied to foundries for use as a fuel in cupolas. The coal tar was sold to a local tar refiner, and the coke oven gas was either used as a fuel on-site, sold, or flared.

Operations began at the facility in the early 1900's when the first battery of coke ovens was constructed. Detroit Coke Corporation has owned the facility since 1980. Detroit Coke Corporation operated the #4 battery from January 1980 until September 1991 when operations ceased and the plant was closed.

1.3.2 *Past Data Collection Activities*

General: A Toxic Release Inventory for the Detroit Coke site was reported in 1990. The U.S. EPA has also prepared an RFA for the Detroit Coke facility. The RFA report, dated December 2, 1992, was based on materials found in facility and agency files, the preliminary RFA submitted by Detroit Coke **Corporation**, and the Visual Site Inspection performed by the agency on July 15-16, 1992. The U.S. EPA determined that the facility has 13 SWMUs requiring additional investigation and possible corrective action.

Air: The facility operates under MDEQ and Wayne County Air Commission Control standards.

Surface Water: To date, no surface water sampling has taken place at the site.

Soil: Refer to "RCRA Facility Investigation Release Assessment", September, 1995.

Ground Water: Same as for soil.

1.3.3 *Current Status*

Coking operations ceased at the facility in September 1991. The facility is currently used to store and load bulk coal, coke, and limestone. Since the closure of coking operations, Detroit Coke **Corporation** has emptied and removed tanks, pipelines, and containment units at the facility. Select facility buildings **have also been demolished**. Interim Measures taken at the site pursuant to a RCRA Facility Assessment include:

- Accumulated coal tar residuals are being removed from SWMU 11;
- Underground lines such as coke oven gas lines have been removed;
- Pre-demolition asbestos abatement has been performed;
- No. 6 fuel oil tank has been removed; and
- Under contract to Detroit Coke **Corporation**, Murphy Demolition Inc. has **demolished** about 95% of site structures, including warehouses.

1.4 PROJECT OBJECTIVES

1.4.1 Specific Objectives and Associated Tasks

The following are the specific RFI objectives and associated tasks:

Objective	Tasks
<ul style="list-style-type: none">Establish the Site Target List for soil and ground water analytical parameters.	<ul style="list-style-type: none">Re-sample surface soil at RA background sample location BG-04 and analyze for Volatile Organic Compounds (U.S. EPA Method 8260) and the "Michigan 10 Metals" on an expedited turn around schedule.Collect 57 surface soils from the two large SWMU areas. Preserve all samples for potential laboratory analysis and field screen visually and using a PID for evidence of impact.Select one surface soil sample from each of the two areas based on field screening such that the sample has the greatest potential for impact and analyze for Semi-Volatile and Volatile Organic Compounds and the "Michigan 10 Metals" on an expedited turn around schedule.Review the expedited analytical results and determine what, if any, constituents should be added to the Site Target List for soils (aromatic hydrocarbons and BNAs including pyridine). Constituents that exceed Part 201 generic industrial standards will be added to the Site Target List for soils.Review additions for soils to determine if any of those constituents should be added to the target list for groundwater.

Objective	Tasks
<ul style="list-style-type: none"> Determine whether surface soils at the Tar Tank Area SWMUs, By-Products Containment Area SWMUs and SWMU 15 are a direct human contact risk. 	<ul style="list-style-type: none"> Collect 5 surface soil samples at SWMU 15. Preserve for laboratory analysis and field screen the samples. Select 25% of the soil samples collected from each of the two large SWMU areas for laboratory analysis based on field screening results: those showing the greatest evidence of impact will be analyzed for the site target list parameters for soil. (It may be necessary to extract these samples for VOC and SVOC scans to extend their hold time long enough to allow development of the Site Target List for soils). Screen results against generic or site specific industrial cleanup criteria and background as specified under Part 201 of Michigan Act 451.
<ul style="list-style-type: none"> Determine the background soil concentration for any additional parameters to the Site Target List for soil, as appropriate (especially metals). 	<ul style="list-style-type: none"> Collect 8 background soil samples and analyze for the constituents of interest. Establish background value in accordance with MDEQ guidance.
<ul style="list-style-type: none"> Determine upgradient ground water quality with respect to any new parameters on the Site Target List for ground water and supplement the background water quality data base for parameters from the RA. 	<ul style="list-style-type: none"> Sample upgradient monitoring wells MW-4 and MW-5 and analyze for parameters on the Site Target List for ground water.
<ul style="list-style-type: none"> Determine whether ground water proximate to the SWMUs is impacted due to constituents on the Site Target List for ground water. Impact will be determined based on comparison to Part 201 generic or site specific industrial cleanup criteria. 	<ul style="list-style-type: none"> Install two shallow monitoring wells, one adjacent to the River Rouge and one adjacent to the Detroit River downgradient of the SWMUs, which complete the perimeter monitoring network.

Objective	Tasks
	<ul style="list-style-type: none"> • Install two other shallow monitoring wells, one upgradient and one downgradient of the Tar Tank Area SWMUs. • Sample these four new wells. The two wells adjacent to the Detroit and Rouge Rivers will be sampled quarterly for one year, and the two wells adjacent to the Tar Tank Area SWMUs will be sampled once during the first round of perimeter sampling. • Analyze all ground water samples for parameters on the Site Target List for ground water.
<ul style="list-style-type: none"> • Determine if ground water at the downgradient site perimeter poses a risk to the rivers. Impact will be determined based on comparison to Part 201 generic or site specific industrial cleanup criteria. 	<ul style="list-style-type: none"> • Install two shallow monitoring wells, one adjacent to the River Rouge and the other adjacent to the Detroit River, downgradient of the large SWMU areas to complete the perimeter monitoring network. • Sample and analyze ground water from the two new perimeter monitoring wells and P-4S, P-3S, P-2S, MW-5, P-6D, P-1S, and P-5S on a quarterly basis for one year. Analyze all ground water samples for parameters on the Site Target List.

The sampling locations are presented in Section 4.3 of the PMP and sampling protocols are presented in the FSP.

It is important to note that VOC samples from soil will be preserved according to the new method 5035 in the latest release of SW-846. Soil samples collected for VOC analysis will be preserved for low level analysis using either field or laboratory preservation techniques. In the event laboratory preservation is preferred, then EnCore-type sampling devices will be used. Soil samples collected for VOCs will be tested using analytical method 8260 which is consistent with MDEQ requirements.

1.4.2 Project Target Parameters and Intended Data Usages

Sample matrices, analytical parameters and frequencies of sample collection are presented in Table 1-1. The rationale for these parameters and frequencies is described in Section 4.0 of the PMP. Tables 7-1 and 7-3 contain the list of required parameters, the proposed analytical methods, and the expected detection limits.

1.4.2.1 Field Parameters

The field parameters to be measured are listed in Table 1-1.

1.4.2.2 Laboratory Parameters

The laboratory parameters to be analyzed for are listed in Table 7-3. This list of indicator parameters includes base/neutral/acid semi-volatile organic compounds [BNAs including pyridine where coking by-products were handled or polynuclear aromatic compounds (PNAs) where oil or coal tar was handled] and purgeable aromatic hydrocarbons. The rationale for the selection of these parameters is presented in Section 4.0 of the PMP.

Additional analytical parameters may be added subsequent to re-sampling and analysis of RA worst case soils located at BG-4 for volatile organic compounds and the "Michigan 10 Metals". Additionally, worst case soils from the Tar Tank Area and By-Product Containment Area will be analyzed for volatile and semi-volatile organic compounds and the "Michigan 10 Metals". See Section 4.0 of the PMP for additional details.

1.4.3 Data Quality Objectives

DQOs are qualitative and quantitative statements which specify the quality of the data required to support decisions made during RFI activities. The desired DQOs selected are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. Five analytical levels address various data uses and the QA/QC effort and methods required to achieve the desired level of quality. Table 1-1 summarizes the DQOs for the RFI sampling. These levels are:

- Screening (DQO Level 1): This provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, preliminary comparison to Applicable or Relevant and Appropriate Requirements (ARARs), initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives (bench-scale tests). These types of data include those generated on-site through the use of PID real-time monitoring equipment at the site.

- Field Analyses (DQO Level 2): This provides rapid results and better quality than in Level 1. This level may include mobile lab generated data depending on the level of quality control exercised.
- Engineering (DQO Level 3): This provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile lab generated data and some analytical lab methods (e.g., laboratory data with quick turnaround used for screening but without full quality control documentation). **In the case of expedited data, TriMatrix will provide full "CLP-Like" data deliverables consistent with DQO Level 3 guidelines.**
- Confirmational (DQO Level 4): This provides the highest level of data quality and is used for purposes of risk assessment and evaluation of remedial alternatives. These analyses require full Contract Laboratory Program (CLP) SW-846 like analytical and data validation procedures in accordance with U.S. EPA recognized protocol. This level of DQO will be employed for all RFI samples collected for quantitative analysis, **and the resulting data will consist of a "CLP-Like" deliverable package.**
- Non-Standard (DQO Level 5): This refers to analyses by non-standard protocols, for example, when exacting detection limits or analysis of an unusual chemical compound is required. These analyses often require method development or adaptation. The level of quality control is usually similar to DQO Level 4 data.

1.5 **SAMPLE NETWORK DESIGN AND RATIONALE**

The RFI sampling network and design are in part predicated upon the results of the RA conducted at the site in 1995. Additionally, an expanded hydrogeological investigation, conducted concurrently with the RA, has provided valuable subsurface stratigraphic data regarding the distribution of sediments beneath the site. Using these sources of ground water quality and ground water occurrence data, along with SWMU specific data regarding the two groups of SWMUs that are yet to be investigated, the rationale for both the soil and ground water sampling network to be employed during this initial phase of the RFI have been developed. See Section 4.3 of the PMP for more details regarding the scope of the investigation to be undertaken during this initial phase of the RFI.

Data obtained during the RFI will be input into a Data Management System (DMS) to provide a flexible means to combine and evaluate all of the available data to meet the stated objectives. The DMS will allow data to be compiled in numerous combinations and viewed graphically. The flexibility of the DMS will also facilitate the transfer of the data to other software packages such as geostatistical programs (see DMP).

Direct sampling and analysis will be used to evaluate the impacted media at the site. The following sections describe the general technical approach within each media to be investigated. The actual survey and sampling locations are presented in the FSP.

1.5.1 *Sample Network by Task and Matrix*

Sample matrices, analytical parameters, and frequencies of sample collection can be found in Table 1-1.

1.5.2 *Site Map of Sampling Locations*

The intended soil and ground water sampling locations are shown on Figures 4-2 and 4-3 of the PMP. It is possible, however, that depending on the nature of encountered field conditions some of these locations will be changed. The person who shall be responsible for making such decisions will be the ERM RFI Coordinator whose responsibilities are described in Section 2.5 of this QAPP.

1.5.3 *Rationale of Selected Sampling Locations*

The rationale for why the selected sampling locations and depths were chosen in conjunction with each SWMU is described in Section 4.0 of the PMP.

1.5.4 *Sample Network Summary Table*

The RFI sample network is presented in tabular format on Table 1-1.

1.6 *PROJECT SCHEDULE*

The schedule for the RFI investigation is presented on Figure 1-2. This schedule presents the estimated time necessary to complete each task described in the PMP. The actual time required to implement the investigation will be dependent upon changes in scope, upon the amount of contingency sampling required and possibly upon other factors beyond AlliedSignal's control.

1.6.1 *Anticipated Date of Project Mobilization*

The date of project mobilization is dependent upon U. S. EPA's approval of the various project plans (PMP, FSP, DMP and QAPP).

1.6.2 *Task Bar Chart and Associated Time Frames*

A task bar chart and the associated time frames are presented in Figures 1-2 of the QAPP and 4-4 of the PMP.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

At the direction of the U.S. EPA Project Coordinator, **AlliedSignal** and **ERM** (as **AlliedSignal**'s contractor) have overall responsibility for the direction and quality of all phases of the RFI. **ERM** will be responsible for the quality of the work including QA/QC and will perform the scope of work as directed by **AlliedSignal**. Project management will be provided by **ERM** under the direction of **AlliedSignal**. Soil and ground water samples will be shipped to TriMatrix's Environmental Laboratory at 5555 Glenwood Hills Parkway SE in Grand Rapids, Michigan 49588-8692 (800-634-8655). The various quality assurance and management responsibilities of key project personnel are defined below.

2.1 PROJECT ORGANIZATION CHART

The lines of authority for the RFI are illustrated in Figure 2-1. This chart includes all individuals discussed below.

2.2 MANAGEMENT RESPONSIBILITIES

- *U.S. EPA RFI Project Coordinator:* The U.S. EPA Project Coordinators, *Allen Melcer and Greg Rudloff*, share the overall responsibility for regulatory oversight of all phases of the RFI scope of work.
- *AlliedSignal RFI Project Manager:* *Tim Metcalf*, the **AlliedSignal** RFI Project Manager, is responsible for implementing the project, and has the authority to commit the resources necessary to meet project objectives and requirements. The **AlliedSignal** RFI Project Manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The **AlliedSignal** RFI Project Manager will report directly to the U.S. EPA RFI Project Coordinator and will provide the major point of contact and control for matters concerning the project. The **AlliedSignal** RFI Project Manager will:
 - define project objectives and develop a detailed work plan schedule;
 - establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
 - acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints;

- orient all field leaders and support staff concerning the project's special considerations;
 - monitor and direct the field leaders;
 - develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
 - review the work performed on each task to ensure its quality, responsiveness, and timeliness;
 - review and analyze overall task performance with respect to planned requirements and authorizations;
 - approve all external reports (deliverables) before their submission to U.S. EPA Region 5;
 - ultimately be responsible for the preparation and quality of monthly progress reports, draft and final design specifications, and final construction report; and
 - represent the project team at meetings and public hearings.
- **ERM RFI Project Manager: C. George Lynn, C.P.G.**, is the ERM RFI Project Manager. At the discretion of the AlliedSignal RFI Project Manager, a number of the AlliedSignal RFI Project Manager's responsibilities may be directly delegated to the ERM RFI Project Manager. The ERM RFI Project Manager will provide direction for the entirety of the ERM project team and be responsible for communications and project deliverables to AlliedSignal. Responsibilities held jointly with the AlliedSignal RFI Project manager will include:
 - approval of all external reports (deliverables) before their submission to U.S. EPA Region 5;
 - the preparation and quality assurance of monthly progress reports, draft and final design specifications, and final construction report; and
 - representation of the project team at meetings and public hearings.
 - **ERM RFI Technical Manager: Randy Cooper, P.E.**, is the ERM RFI Technical Manager. At the discretion of the AlliedSignal RFI Project Manager, a number of the AlliedSignal RFI Project Manager's responsibilities may be directly delegated to the ERM RFI Technical Manager. Responsibilities held jointly with the AlliedSignal RFI Project manager will include:

- acquisition and application of technical and corporate resources as needed to ensure performance within budget and schedule constraints;
- monitoring and directing the field leaders;
- developing and meeting ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- review of the work performed on each task to ensure its quality, responsiveness, and timeliness; and
- review and analysis of overall task performance with respect to planned requirements and authorizations.

2.3 *QUALITY ASSURANCE RESPONSIBILITIES*

- *U.S. EPA Region 5 Quality Assurance Manager (RQAM):* EPA RQAM has the responsibility to review and approve all Quality Assurance Project Plans (QAPPs). Additional U.S. EPA responsibilities include:
 - Conducting external Performance and System Audits of the TriMatrix Environmental Laboratory; and
 - Reviewing and evaluating analytical field and laboratory procedures.
- *ERM RFI QA Director:* The ERM RFI QA Director is John Imse, P.G.. The QA Director will remain independent of direct job involvement and day-to-day operations, and have direct access to corporate executive staff as necessary to resolve any QA dispute. He is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, ERM's policies, and U.S. EPA requirements. Specific functions and duties include:
 - providing QA audit on various phases of the field operations;
 - reviewing and approval of QA plans and procedures;
 - providing QA technical assistance to project staff; and
 - reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the ERM RFI Project Manager.

- *TriMatrix RFI Laboratory Quality Assurance Officer:* The TriMatrix RFI Laboratory Quality Assurance Officer is **Rick Wilburn**. As Laboratory QA Officer he:
 - oversees laboratory quality assurance;
 - oversees laboratory QA/QC documentation;
 - conducts detailed laboratory data review;
 - decides laboratory corrective actions, if required;
 - presents technical laboratory QA procedures;
 - prepares laboratory standard operation procedures; and
 - ensures that the laboratory protocols specified in the QAPP are followed.

Independent Laboratory Data Validation will be provided by **Kathleen A. Blaine**. Ms. Blaine is a Senior Quality Assurance Chemist with Environmental Standards, Inc., a firm which specializes in the field of data validation. Ms. Blaine has over 11 years of experience as a data validation specialist. She is also experienced in laboratory auditing and bench chemistry analysis.

2.4 LABORATORY RESPONSIBILITIES

- *TriMatrix RFI Laboratory Operations Manager:* The TriMatrix RFI Laboratory Operations Manager is **Doug Kriscunas**. As Operations Manager, Mr. Kriscunas:
 - ensures all resources of the laboratory are available on an as-required basis;
 - oversees final analytical reports; and
 - ensures that the protocols specified in the QAPP are followed.
- *TriMatrix RFI Laboratory Project Manager:* The TriMatrix RFI Laboratory Project Manager is **Jerry Holycross**. As Laboratory Project Manager, he:
 - coordinates laboratory analyses;
 - supervises in-house chain-of-custody;
 - oversees laboratory data review;

- oversees preparation of analytical reports; and
- approves final analytical reports prior to submittal to ERM.
- *TriMatrix RFI Laboratory Sample Custodian:* The TriMatrix Laboratory Sample Custodian is **Keith Banschoff**. As Sample Custodian, he:
 - receives and inspects the incoming sample containers;
 - records the condition of the incoming sample containers;
 - signs appropriate documents;
 - verifies chain-of-custody and its correctness;
 - notifies Laboratory Project Manager of sample receipt and inspection;
 - assigns a unique identification number and customer number, and enters each into the sample receiving log;
 - initiates, with the help of the Laboratory Project Manager, transfer of the samples to appropriate laboratory sections; and
 - controls and monitors access/storage of samples and extracts.

The primary responsibility for project quality rests with the **AlliedSignal RFI Project Manager** in conjunction with the **ERM RFI project team**. Independent quality assurance will be provided by the **TriMatrix RFI Laboratory Project Manager** and the **ERM RFI QA Director** prior to the release of data packages.

The location of the laboratory is:

TriMatrix Laboratories, Inc.
5555 Glenwood Hills Parkway Southeast
Grand Rapids, MI 49588-8692
800-634-8655 or
616-975-4500
616-940-4470 fax

2.5 **FIELD RESPONSIBILITIES**

- *ERM RFI Coordinator:* **ERM RFI Coordinator, Doug Burge, P.G.**, will be supported by the **ERM technical and field staff**. He will be responsible for leading and coordinating the day-to-day activities of the various resource specialists under her supervision. The **ERM RFI Coordinator** is a highly

experienced environmental professional and will report directly to the ERM RFI Technical Manager. Specific ERM RFI Coordinator responsibilities include:

- implementation of field-related plans, assurance of schedule compliance, and adherence to management-developed study requirements;
 - coordination and management of field staff including sampling and subcontractors;
 - implementation of QC for technical data provided by the field staff including field measurement data;
 - adherence to work schedules provided by the ERM RFI Technical Manager;
 - authorship, review, and approval of text and graphics required for field team efforts; and
 - identification of problems at the field team level, discussion of resolutions with the ERM RFI Technical Manager, and provision of communication between project team members and upper management.
- *ERM RFI Technical and Field Staff:* The ERM RFI technical and field staff for this project will be drawn from ERM's multi-disciplinary corporate resources. The technical and field staff will be utilized to gather and analyze data, and to prepare various task reports. All of the designated technical and field team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

Upper level quality assurance and quality control will be exercised by Dr. Elsie Millano, Ph.D., P.E. Dr. Millano is a Senior Project Manager with ERM and has extensive experience in quality assurance and quality control.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY

The overall quality assurance (QA) objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide high quality results which are legally defensible in a court of law. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to address the specific objectives for accuracy, precision, completeness, representativeness, and comparability.

The fundamental QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols.

SOPs for laboratory analyses are provided in Appendix A². The SOPs address the required accuracy, precision, and sensitivity of the analyses.

3.1 PRECISION

3.1.1 Definition

Precision refers to how closely two or more measurements of the same parameters or property agree with each other. Duplicate measurements will be made in the field to determine the precision of the field measurement. Matrix spike duplicates will be used to assess laboratory precision.

3.1.2 Field Precision Objectives

The precision of the field measurements is determined by evaluation of duplicate measurements. For this site, only PID screening measurements will be performed. Duplicate readings will not be required for these measurements.

3.1.3 Laboratory Precision Objectives

Measurement of precision is mathematically defined for laboratory analysis in Section 12.2.

² Bound separately.

3.2 ACCURACY

3.2.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference value.

3.2.2 Field Accuracy Objectives

The accuracy of the field data will be maintained by ensuring instruments are in good working condition and properly calibrated (see Section 6.1). The accuracy of the PID field screening will be evaluated in conjunction with the instrument calibration records to ensure the highest possible accuracy. Accuracy in the field will also be assessed through the use of equipment rinse and trip blanks and through adherence to all sample handling, preservation and holding time requirements.

3.2.3 Laboratory Accuracy Objectives

Laboratory accuracy is mathematically defined in Section 12.1. Accuracy control limits are given in the laboratory SOPs in Appendix A³.

3.3 COMPLETENESS

3.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is in Section 12.3 of this QAPP. Field completeness for this project will be greater than 90 percent.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements **planned** for the project. The equation for

³ Bound separately.

completeness is presented in Section 1.2.3 of this QAPP. Laboratory completeness for this project will be greater than 90 percent.

3.4 REPRESENTATIVENESS

3.4.1 Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of facility conditions.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is a qualitative parameter which is dependent upon the proper design of the various monitoring programs and proper laboratory protocol. The monitoring plans are designed to provide data representative of site conditions. During development of these plans, consideration was given to the data presented in the RFA. Representativeness will be satisfied by requiring that the procedures detailed in the FSP are followed, proper sampling techniques are used, proper analytical procedures are followed and holding times of the samples are not exceeded in the laboratory. Representativeness will be assessed by the analysis of field duplicate samples.

3.4.3 Measures to Ensure Representativeness of Lab Data

Representativeness will be satisfied by insuring that proper analytical procedures are followed and holding times of the samples are not exceeded in the laboratory. Representativeness will be assessed by the analysis of field duplicate.

3.5 COMPARABILITY

3.5.1 Definition

Comparability expresses the confidence with which one data set can be compared with another. In most cases. To the extent that. the data collection objectives and analytical methods are similar, data generated during the RFI are expected to be comparable to data that will be generated during the RFI.

3.5.2 *Measures to Ensure Comparability of Field Data*

Comparability is dependent upon proper design of the sampling program and will be satisfied by ensuring that the FSP and QAPP are followed. The methods used to collect field data will be consistent during the RFI ensuring comparability of field data.

3.5.3 *Measures to Ensure Comparability of Lab Data*

The extent to which existing and planned analytical data will be comparable depends on the similarity of the sampling and analytical methods as documented in this QAPP. Comparability is also dependent on similar QA objectives. The methods used to collect for analysis and the methods used to analyze samples will be consistent during the RFI, ensuring comparability of laboratory data.

3.6 *LEVEL OF QUALITY CONTROL EFFORT*

Equipment rinse blank, trip blank, field duplicate and matrix spike samples will be analyzed to assess the quality of the data resulting from the various monitoring programs implemented for this project. Equipment rinse and trip blanks consisting of deionized water will be submitted to the TriMatrix Laboratory to provide the means to assess the quality of the data resulting from the program. Equipment rinse blank samples are analyzed to check for procedural contamination at the site which may cause sample contamination. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. Duplicate samples are analyzed to check for sampling and analytical reproducibility. Matrix spike/matrix spike duplicates (MS/MSD) provide information about the effect of the sample matrix on the digestion and measurement methodology. All matrix spikes are performed in duplicate and are hereinafter referred to as MS/MSD samples. One MS/MSD will be collected for every 20 or fewer investigative samples.

The general level of the QC effort will be one field duplicate blank for every 10 or fewer investigative samples and one equipment rinse blank for every 10 or fewer investigative samples. One trip blank consisting of deionized organic-free water will be included along with each shipment of aqueous volatile organic compounds (VOCs) samples. The trip blank will be analyzed for VOCs only.

MS/MSD samples are investigative samples. Soil MS/MSD samples require no extra volume for VOCs or extractable organics. However, aqueous MS/MSD samples must be collected at triple the volume for VOCs and double the volume for extractable organics. One MS/MSD sample will be collected/designated for

every 20 or fewer investigative samples per sample matrix (i.e., ground water, soil).

The number of field duplicate samples, equipment rinse and trip blank samples, and matrix spike samples to be collected are detailed in the FSP and in Table 1-1. Sampling procedures are also specified in the FSP. A description of field QC sample collection guidelines is provided in the field SOPs contained in Appendix B.

4.0 SAMPLING PROCEDURES

The sampling procedures to be used in the RFI will be consistent for the purpose of this project. Sampling procedures are specified in Section 6.0 of the FSP.

The sampling locations and rationale are presented in the PMP. In summary, representative samples will be collected from potentially impacted media (soil and/or ground water) in the vicinity of the SWMUs, at one background location and at the down gradient perimeter of the site. Actual soil sample locations have been estimated and may be modified based on field observations (i.e. stained or cracked areas in secondary containment structures), with a bias toward obtaining samples of the most potentially impacted soils. Sampling depths have been determined based on SWMU characteristics and to assist in determining the potential risks that may arise from exposure(s) to shallow soils, primarily dermal. For example, if the SWMU structure is simply a shallow containment area, only soils at depths of 0 to 2 feet will be investigated, since any releases due to significant breaches in the containment or overflows will be evidenced at that depth. Soil samples will be collected at multiple depth intervals during the installation of monitoring wells; however, it is not anticipated that soils from these deeper intervals will be quantitatively analyzed rather, a ground water sample will be collected for analysis.

4.1 FIELD SAMPLING BY MATRIX

The field sampling matrix is discussed in Section 4.3 of the PMP and in the FSP. Table 1-1 presents a summary of this information.

4.2 FIELD QC SAMPLE COLLECTION/PREPARATION PROCEDURES

4.2.1 Obtaining Containment-Free Sample Containers

The sample containers used for this RFI will be prepared in accordance with the U.S. EPA, 1990 guidance document, Containment-Free Sample Containers. The bottles used for sampling will not contain contaminants exceeding the level specified in the above mentioned document. I-Chem will issue a certificate of cleanliness for all bottles used. The certificate will be specific for the compounds of concern at the site (BNAs, BTEX and pyridine). Specifications for the bottles will be verified by checking the supplier's certified statement and analytical results for each bottle lot, and will be documented on a continuing basis. This data will be maintained in a central contractor file and will be available, if requested, for U.S. EPA review.

In addition, the data for equipment rinse blanks and trip blanks, etc., will be monitored for contamination, and corrective actions will be taken as soon as a problem is identified.

4.2.2 QC Sample Procedures

The number of duplicate and blank samples to be collected are listed in Table 1-1. Sample procedures are specified below and in the field SOP contained in Appendix B.

4.2.2.1 Equipment Rinse Blank Collection

Equipment Rinse Blanks are rinse water samples obtained after the final planned rinsing step for decontamination of bailers, split spoons, lead auger, etc. These blanks demonstrate that the non-dedicated sampling equipment has been thoroughly cleaned and that the sample collection and handling process has not altered the quality of the sample. The general level of the QC effort will be one equipment rinse blank for every 10 or fewer investigative samples. The equipment rinse blank samples will be analyzed for the same list of parameters as the ground water or soil sample with which they are collected. **Final rinse water for organic constituents will consist of organic free reagent water or HPLC grade water. For inorganic constituents, distilled/deionized water will be used for the final rinse.**

4.2.2.2 Field Duplicative Collection

The general level of the QC effort will be one field duplicate for every 10 or fewer investigative samples. The field duplicate samples will be analyzed for the same list of parameters as the ground water or soil sample with which they are collected.

4.2.2.3 Matrix Spike/Matrix Spike Duplicate Collection

MS/MSD samples are investigative samples. Soil MS/MSD samples require no extra volume for VOCs or extractable organics. However, aqueous MS/MSD samples must be collected at triple the volume for VOCs and double the volume for extractable organics. One MS/MSD sample will be collected/designated for every 20 or fewer investigative samples per sample matrix (i.e., ground water, soil).

4.2.2.4 Trip Blank Preparation

Trip Blanks are organic free reagent or HPLC grade water samples in VOC vials placed in lab chest that are renewed each time a chest is packed or repacked with VOC sample containers. These samples remain unopened in the chest. If these

"blanks" show "detectable" for one or more compounds, the problem could be cross-contamination between sample and container via air in the chest, or lab contamination. One VOC trip blank consisting of distilled deionized ultra pure water will be prepared in TriMatrix's Laboratory and included along with each shipment of aqueous VOC samples.

4.3 *SAMPLE CONTAINERS, PRESERVATIVES AND VOLUME REQUIREMENTS*

Requirements for sample containers, preservation and volume are summarized on Table 7-2.

4.4 *DECONTAMINATION PROCEDURES*

Decontamination procedures are described in Section 5.0 of the FSP.

4.5 *SAMPLE PACKAGING AND SHIPMENT PROCEDURES*

Sample packaging and shipment procedures are summarized on Table 7-2 and described in further detail in the field SOPs in Appendix B.

5.0 CUSTODY PROCEDURES

Custody is one of several factors which is necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis and final evidence files. Final evidence files, including all originals of laboratory reports and purge files, are maintained under document control in a secure area.

A sample or evidence file is under your custody if it is:

- in your possession;
- in your view, after being in your possession;
- in your possession and you place it in a secured location; or
- in your designated secure area.

A chain-of-custody record is a record of all persons who have collected, relinquished and/or received samples and the dates and times when these activities occurred. Items which must be held under a chain-of-custody include samples, sample tags, airbills and a chain-of-custody record form. The chain-of-custody will be initiated in the field and will be maintained through the laboratory. Additional information on the transfer of custody is provided in Section 5.1.3 of the QAPP.

An example of the chain-of-custody form is included in Appendix C.

5.1 FIELD CUSTODY PROCEDURES

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain-of-custody intact. The protocol for specific sample labeling is included in Section 3.1 of the FSP.

5.1.1 Field Procedures

The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

- All bottles will be tagged with sample numbers and locations, date/time of collection, and type of analysis. The sample numbering system is presented in Section 3.1 of the FSP.
- A sample tag will be attached to each individual sample aliquot for each investigative or quality control sample. The sample tag will include the following information: the field sample number (which will include the location of the sample), date and time of collection, type of analysis, type of preservative (if any), a space for the lab sample number, project identification, and the name of the person collecting the sample. The tag may also include a space for comments. The sample tag will be attached to the sample container with a wire around the container neck through a reinforced hole in the tag. Sample tags will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ball-point pen would not function in freezing weather.
- The ERM Project Coordinator will review all field activities to determine whether proper custody procedures were followed during the field work and decide if additional samples are required.

5.1.2 Field Logbooks/Documentation

Field logbooks will provide the means of recording data collection activities. As such, entries will be described in as much detail as possible so that persons going to the facility could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control center when not in use. Each logbook will be identified by the project-specific document number.

The title page of each logbook will contain the following:

- Person to whom the logbook is assigned;
- Logbook number;
- Project name;
- Project start date; and
- End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered.

The names of visitors to the site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook.

A record will be kept of field measurements and collected samples. All entries will be made in ink signed and dated and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark signed and dated by the sampler. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station, which includes compass and distance measurements, shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in Section 6.0 of the FSP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume and number of containers. The sample identification number will be assigned prior to sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description. The system for assigning a sample identification number is described in Section 3.1 of the FSP.

5.1.3 *Transfer of Custody and Shipment Procedures*

- Samples are accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.
- Samples will be properly packaged on ice at 4°C for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record secured to the inside top of each sample box or cooler. Shipping containers will be locked and secured with strapping tape and custody seals for shipment to the laboratory. The preferred procedure includes use of a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.
- Whenever samples are co-located with a government agency, a separate sample receipt is prepared for those samples and marked to indicate with whom the samples are being collected. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses

to sign, this is noted in the "Received By" space. **For the scope of work proposed in this RFI Work Plan, co-located samples will not be collected.**

- All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment. The pink and yellow copies will be retained by the sampler for return to the sampling office.
- Airbills or bills of lading will be used when samples are sent by Federal Express, UPS, Airborne Express or Express Mail. Receipts of airbills or bills of lading will be regained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. The custody forms will be sealed inside the sample cooler and coolers will be sealed intact; therefore, the commercial carriers will not be required to sign off on the custody form.
- Whenever possible, samples will be transported by overnight carrier to the laboratory the same day the samples are collected in the field.

5.2 LABORATORY CUSTODY PROCEDURES

All samples will be received at the TriMatrix Laboratory by the Sample Custodian (SC). It will be the responsibility of the SC to determine whether or not the samples are close to exceeding their holding time and require immediate attention and the manner in which those samples will be split, preserved and stored or routed. It is the objective of the SC to insure that all pertinent information relative to those samples is recorded. This information may be used in client reports, communicated to the laboratory or to the client and, in some cases, reported to a legal authority relative to chain-of-custody samples.

The sample custodian is responsible for the receipt, log-in, and access controlled storage of all client samples at the TriMatrix Laboratory. Each sample is labeled with a unique number which is entered into the sample receiving log and LIMS system. The samples are placed into appropriate storage within an access controlled location. Sample extracts are signed out by the chemist performing the analysis and subsequently signed in when the samples are returned to the access controlled storage location. All samples are maintained under proper storage conditions for thirty days past the generation of the analytical report.

A chain-of-custody sample control record is used as the documentation for the movement of chain-of-custody samples in and out of the access controlled storage. The analyst signs samples in and out each time a sample(s) is removed

for any analysis. A copy of the form is included in Appendix D⁴. After all analyses are complete, the sample custodian files the form in a chain-of-custody file specific to the project.

5.3 *FINAL EVIDENCE FILES*

The final evidence file will be the central repository for all documents which constitute evidence relevant to sampling and analysis activities as described in this QAPP. The ERM RFI Project Manager is custodian of the final evidence file and maintains the contents of evidence files for the RFI, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports and data reviews in a secured, limited access area and under custody of the ERM RFI Project Manager. All evidence in the file will be retained for a period of five years from the date the evidence is generated. After that time, the files will be offered to the U.S. EPA prior to disposal.

⁴ Bound separately.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all the instruments and measuring equipment which are used for conducting field and laboratory analyses. These instruments and equipment should be calibrated prior to each use or on a scheduled, periodic basis.

6.1 FIELD INSTRUMENT CALIBRATION

A photoionization detector (PID) will be used during the field investigation. All instruments will be calibrated at least daily according to manufacturer's instructions, and all calibration data shall be recorded in dedicated calibration logbooks or field logbooks. No other field measurements will be taken.

6.2 LABORATORY INSTRUMENT CALIBRATION

Calibration of laboratory equipment will be based on approved written procedures contained in the laboratory SOPs (Appendix A⁵) for the appropriate analytical method and listed in Table 6-1. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory analyst. These records will be filed at the location where the work is performed and will be subject to QA audit. For all instruments, the laboratory maintains in-house spare parts or service contracts with vendors.

6.2.1 Organic Analyses

Prior to calibration, the instrument(s) used for gas chromatograph/mass spectrometer (GC/MS) analyses are tuned by analysis of p-bromofluorobenzene for VOC analyses and decafluorotriphenyl phosphine (DFTPP) for semi-volatile organic compound analyses (SVOCs). Once the tuning criteria for these reference compounds are met, the instrument is initially calibrated by using a five point calibration curve. The instrument tune will be verified each 12 hours of operation. Continuing calibration is verified as specified in the method. The calibration standards are commercially available certified standards and are spiked with internal standards and surrogate compounds.

Analysis done by gas chromatography will basically follow SW-846 protocols. The instrument will be calibrated using a five point calibration curve for volatile

⁵ Bound separately.

compounds and a five point calibration curve for semi-volatile compounds. Continuing calibrations shall be performed after every ten samples.

7.0 ANALYTICAL AND MEASUREMENT PROCEDURES

All ground water and soil samples collected during field sampling activities for the Detroit Coke RFI will be analyzed by the TriMatrix Laboratory Division in Grand Rapids Michigan.

7.1 FIELD ANALYTICAL AND MEASUREMENT PROCEDURES

The standardization and QA information for field measurements of (VOC content in headspace) is described in Section 3 of this QAPP. Field methodologies are provided in the FSP. The SOP for the headspace screening for VOC content is found in Appendix B.

7.2 LABORATORY ANALYTICAL AND MEASUREMENT PROCEDURES

Standard operating procedures have been prepared for all methods used for analysis of samples for this project. These project specific laboratory SOPs are included in Appendix A⁶.

Each of these SOPs is based on an analytical method published by the U.S. EPA. Each specifies:

- procedures for sample preparation,
- instrument start up and performance check;
- initial and continuing calibration check requirements,
- specific methods for each sample matrix type; and
- required analysis procedures.

7.2.1 List of Project Target Compounds and Detection Limits

Tables 7-1 through 7-3 provide a summary of analytical methods, bottle requirements, preservatives, holding times and project specific detection limits.

7.2.2 List of Associated QC Samples

The laboratory SOPs include a QC section which addresses the minimum QC requirements for the analysis of specific analyte groups. Since the RFI is the first comprehensive investigation performed at the site, no specific compounds have been identified as chemicals of concern. Therefore, no specific compounds will be

⁶ Bound separately.

added to the spiking solution, rather normal QA/QC measures will be implemented.

If it cannot be demonstrated that the Site Target List compounds are being analyzed in an accurate and precise manner, the analytical approach will be reviewed and changed as necessary. An example of a potential change is to modify the matrix spike spiking solution to include the poor purging compounds. The list of VOC spiking compounds presented in the QAPP is consistent with the recommendations of the referenced analytical methods 5000, 5030, 5035, 8000, and 8260.

8.0 *INTERNAL QUALITY CONTROL CHECKS*

8.1 *FIELD QC CHECKS*

The QC information for field equipment is stated in Section 3.0 of this QAPP. Soil color checks, if required, will be done using Munsell color charts. Assessment of field sampling precision and bias will be made by collecting field duplicates and equipment rinse blanks for laboratory analysis. Collection of the samples will be in accordance with the applicable procedures in Section 4.0 of this QAPP and Section 6.0 of the FSP.

8.2 *LABORATORY QC CHECKS*

The quality assurance program and quality control checks described in this section will be used by the TriMatrix Laboratory for production of analytical data of known and documented usable quality.

8.2.1 *Quality Assurance Program*

The TriMatrix Laboratory has a written Quality Assurance/Quality Control (QA/QC) program which provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory. Compliance with the QA/QC program is coordinated and monitored by the laboratory's quality assurance officer.

The stated objectives of the laboratory QA/QC program are to:

- be sure that all procedures are documented, including any changes in administrative and/or technical procedures;
- be sure that all analytical procedures are conducted according to sound scientific principles and have been validated;
- monitor the performance of the laboratory by a systematic inspection program and provide for a corrective action as necessary; and
- be sure that all data are properly recorded and archived.

All laboratory procedures are documented in writing as standard operating procedures (SOPs) which are edited and controlled by the TriMatrix Laboratory. Internal quality control procedures for analytical services will be conducted by TriMatrix Laboratory in accordance with their standard operating procedures

and the individual method requirements in a manner consistent with the TriMatrix Laboratory's QA/QC Procedures Manual (Appendix D⁷).

8.2.2 *Quality Control Checks*

TriMatrix Laboratory SOPs include the types of audits required (sample spikes, surrogate spikes, reference samples, controls, blanks), the frequency of each audit, the compounds to be used for sample spikes and surrogate spikes, and the quality control acceptance criteria for these audits.

The TriMatrix Laboratory will document, in each data package provided, that both initial and ongoing instrument and analytical QC functions have been met. Any samples analyzed in non-conformance with the QC criteria will be reanalyzed by the laboratory. It is expected that sufficient volume of samples will be collected for re-analysis. Method specific data quality objectives for precision, accuracy and surrogate recoveries are found in Tables 8-1 and 8-2.

8.2.3 *Method Blank Samples*

A method blank sample will be analyzed by the laboratory at a frequency of one blank per twenty samples or batch, whichever is less. The method blank, an aliquot of laboratory reagent water or sand will be carried through the entire analytical procedure.

8.2.4 *MS/MSD*

Matrix spikes and duplicates will be analyzed at a frequency of one MS/MSD or MS/Duplicate per twenty investigative samples or batch, whichever is less. Spike recoveries will be used to evaluate analytical accuracy while relative percent difference between the duplicate analyses will be used to assess precision.

8.2.5 *Surrogate Compounds*

Surrogate compounds are used in all GC/MS procedures. All samples including blanks, spikes and control samples are spiked with surrogate compounds prior to analysis. Surrogate spike recoveries must fall within the control limits listed in Table 8-2. Failure to pass these criteria will result in re-analysis to verify the existence of a matrix interference. Dilution of samples may dilute the surrogates out of the quantitation limit.

⁷ Bound separately.

8.2.6 *Laboratory Control Samples*

A quality control check sample will be analyzed with each analytical batch or twenty samples, whichever is less. These samples are prepared by use of standards independent of the calibration standards, and are carried through the complete analytical process. Control limits are specified in the laboratory SOPs contained in Appendix A⁸.

8.2.7 *Trip Blanks*

Trip blanks are submitted with volatile organic samples only, and will be used to determine if cross-contamination occurs during the shipment of samples.

The TriMatrix Laboratory routinely updates control limits for precision, accuracy and surrogate recoveries. The limits listed in Tables 8-1 and 8-2 may vary slightly when actual sampling begins.

⁸ Bound separately.

9.0 DATA REDUCTION, VALIDATION AND REPORTING

All data generated through in field activities, or by the laboratory operation shall be reduced, and validated prior to reporting. No data shall be disseminated by the laboratory until it has been subjected to these procedures which are summarized in subsections below.

9.1 DATA REDUCTION

9.1.1 Field Data Reduction Procedures

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting. Direct measurement readings will be taken from the PID following calibration per manufacturer's recommendations as outlined in Section 6 of this QAPP. Such data will be written into field log books immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Later, when the results forms required for this study are being filled out, the ERM RFI Coordinator, identified in Section 2.0 of this QAPP, will proof the forms to determine whether any transcription errors have been made by the field crew.

9.1.2 Laboratory Data Reduction Procedures

TriMatrix Laboratory will perform in-house analytical data reduction under the direction of the Laboratory QA Officer.

Data reduction by the laboratory will be conducted as follows:

- Raw data produced by the analyst is turned over to the respective area supervisor.
- The area supervisor reviews the data for attainment of quality control criteria as outlined in established U.S. EPA methods and for overall reasonableness.
- Upon acceptance of the raw data by the area supervisor, a computerized QA report is generated and sent to the Laboratory QA Officer.

9.2 DATA VALIDATION

9.2.1 Procedures Used to Validate Field Data

Procedures to evaluate field data for this project primarily include checking for transcription errors and review of field log books, on the part of field crew members. This task will be the responsibility of the ERM RFI Coordinator, who will otherwise not participate in making any of the field measurements, or in adding notes, data or other information to the log book.

9.2.2 Procedures Used to Validate Lab Data

The TriMatrix Laboratory will perform in-house analytical data validation under the direction of the Laboratory QA Officer. The Laboratory QA Officer is responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other notations which would caution the data user of possible unreliability.

Data validation by the laboratory will be conducted as follows:

- The Laboratory QA Officer will complete a thorough audit of preliminary reports at a frequency of one in ten.
- The Laboratory QA Officer and area supervisors will decide whether any sample re-analysis is required.

The TriMatrix assessment of laboratory data will be accomplished by the joint efforts of the TriMatrix Laboratory QA Officer and TriMatrix RFI Laboratory Project Manager. The data assessment by the Laboratory Project Manager will be based on the assumption that the sample was properly collected and handled according to the FSP and Section 2.5 of this QAPP.

The TriMatrix data reviewers will conduct a systematic review of the data for compliance with the established QC criteria based on the spike, duplicate and blank results provided by the laboratory. An evaluation of data accuracy, precision, sensitivity and completeness based on criteria discussed in Section 3.0 of this QAPP will be performed.

Data validation independent of the TriMatrix Laboratory as discussed in Section 2.3 of this QAPP will be performed at a frequency of one hundred percent.

The data reviewers will identify any out-of-control data points and data omissions and will interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the ERM RFI Project Manager based on the extent of the deficiencies and their importance in

the overall context of the project. The ERM RFI Project Manager will seek U.S. EPA advisement and approval prior to repeating any sample collection and analysis.

9.3 DATA REPORTING

9.3.1 Field Data Reporting

Field data reporting shall be conducted principally through the transmission of report sheets containing tabulated results of all measurements made in the field, and documentation of all field calibration activities. If field logbook information is to be used in the project reports, it will likely be presented in a tabular format.

9.3.2 Laboratory Data Reporting

Upon acceptance of the preliminary reports by the Laboratory QA Officer, final reports will be generated and signed by the Laboratory Project Manager. The laboratory package shall be presented in the same order in which the samples were received.

TriMatrix Laboratory will prepare and retain full analytical and QC documentation similar to that required by the contract laboratory program. Such retained documentation need not be hard (paper) copy, but may be in other storage media (e.g., magnetic tape). TriMatrix Laboratory will supply a hard copy of the retained information on an as needed or as requested basis.

TriMatrix Laboratory will report the data in the same chronological order in which analyses are conducted, along with QC data. Each analytical data package will include the following:

- cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis;
- tabulated results of organic compounds identified and quantified for investigative and blank samples;
- analytical results for sample spikes, sample duplicates, and laboratory control samples; and
- tabulation of instrument detection limits determined in pure water.

For organic analyses, surrogate spike recoveries, chromatograms, GC/MS spectra, computer printouts, calibration verification of standards and blanks, standard procedural blanks, raw data system printouts (or legible photocopies)

identifying data of analyses, analyst's name, and parameters determined, will be retained by TriMatrix Laboratory. This data will be made available upon request.

All data generated for the Detroit Coke RFI will be computerized in a format organized to facilitate data review and evaluation. The Detroit Coke RFI data set will be available for controlled access by the ERM RFI Project Manager and by authorized personnel using a site-specific code. The final data deliverables will be presented in a "CLP-like" format.

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the FSP and the QAPP. The audits of field and laboratory activities include two separate independent parts: internal and external audits.

10.1 FIELD PERFORMANCE AND SYSTEM AUDITS

10.1.1 Internal Field Audits

10.1.1.1 Internal Field Audit Responsibilities

Internal audits of field activities including sampling and field measurements may be conducted by the ERM QA Director.

10.1.1.2 Internal Audit Frequency

Internal field audits may occur at the onset of the project to verify that all established procedures are followed. Follow-up audits will be conducted in the event of deficiencies, to verify that required QA procedures are maintained throughout the investigation.

10.1.1.3 Internal Field Audit Procedures

Internal audits of field activities (sampling and measurements) may be conducted by the ERM QA RFI Director and/or ERM RFI Coordinator. The audits will include examination of field sampling and measurement records, field instrument calibration and operating records, and sample collection, handling, packaging, and documentation in compliance with the established procedures. The internal field audit checklist to be used for this project is included in Appendix C.

10.1.2 External Field Audits

10.1.2.1 External Field Audit Responsibilities

An external audit may be conducted at the discretion of the U.S. EPA RCRFI Project Coordinator.

10.1.2.2 External Field Audit Frequency

External field audits may be conducted any time during the field operations. These audits may or may not be announced and are at the discretion of the U.S. EPA.

10.1.2.3 Overview of the External Field Audit Process

External field audits will be conducted according to the field activity information presented in the QAPP.

10.2 LABORATORY PERFORMANCE AND SYSTEMS AUDITS

10.2.1 Internal Laboratory Audits

10.2.1.1 Internal Lab Audit Responsibilities

The internal performance and system audits of the TriMatrix Laboratory will be conducted by the TriMatrix Laboratory QA officer.

10.2.1.2 Internal Lab Audit Frequency

The system audits, which will be done on an annual basis, will include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedure, sample preparation and analysis, and instrument operating records.

10.2.1.3 Internal Lab Audit Procedures

The internal lab system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc. The performance audits will involve preparing blind QC samples and submitting them along with project samples to the laboratory for analysis throughout the project. The TriMatrix Laboratory QA Officer will evaluate the analytical results of these blind performance samples to ensure the laboratory maintains acceptable QC performance. The laboratory audit checklist is shown in Table 10-1. The results of internal blind audit sampling relevant to this project will be reported to the U.S. EPA.

10.2.2 External Laboratory Audits

10.2.2.1 External Lab Audit Responsibilities

An external audit will be conducted at the discretion of the U.S. EPA Region 5 Central Regional Laboratory (CRL).

10.2.2.2 External Lab Audit Frequency

An external lab audit will be conducted at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced and are at the discretion of the U.S. EPA.

10.2.2.3 Overview of the External Lab Audit Process

External lab audits will include (but not be limited to) review of laboratory analytical procedures, laboratory on-site audits, review of "typical" data deliverables packages and/or submission of performance evaluation samples to the laboratory for analysis.

11.0 PREVENTIVE MAINTENANCE PROCEDURES

11.1 FIELD INSTRUMENT PREVENTIVE MAINTENANCE

A PID will be used during the field investigation. Specific preventative maintenance procedures to be followed are those recommended by the manufacturer. This instrument will be checked and calibrated daily before use and as necessary thereafter. Backup instruments and equipment will be available on-site or within 1 day shipment to avoid delays in the field schedule.

11.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

As part of their QA/QC program, a routine preventive maintenance program is conducted by TriMatrix Laboratory to minimize the occurrence of instrument failure and other system malfunctions. TriMatrix Laboratory staff performs preventive maintenance and repairs or coordinates with a vendor for the repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument service logbook, for each instrument. Emergency repair or scheduled manufacturer's maintenance is provided under a repair and maintenance contract with factory representatives. The routine preventative maintenance procedures and schedules are presented in Table 11-1.

12.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1 ACCURACY ASSESSMENT

Accuracy of laboratory results will be assessed for compliance with the established QC criteria that are described in Section 3.2 of the QAPP using the analytical results of method blanks, reagent/preparation blank MS/MSD samples, equipment rinse blank, and trip blanks. The percent recovery (%R) of matrix spikes will be calculated using:

$$\%R = \frac{A - B}{C} \times 100$$

Where:

A = the analyte concentration determined experimentally from the spiked sample;

B = the background level determined by a separate analysis of the unspike sample; and

C = the amount of the spike added.

12.2 PRECISION ASSESSMENT

Precision of laboratory analyses will be assessed by comparing the analytical results between MS/MSD for organic analyses. The relative percent difference (%RPD) will be calculated for each pair of duplicate analyses using:

$$\%RPD = \frac{S - D}{(S + D)/2} \times 100$$

Where:

S = first sample value (original or MS value)

D = second sample value (duplicate or MSD value)

12.3 COMPLETENESS ASSESSMENT

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using:

$$\text{Completeness} = \frac{\text{valid data obtained}}{\text{total data planned}} \times 100$$

13.0 CORRECTION ACTIONS

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or out of quality control performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All corrective action proposed and implemented should be documented in the regular quality assurance reports to management. Corrective action should only be implemented after approval by the **AlliedSignal** RFI Project Manager, or his designee. If immediate corrective action is required, approvals secured by telephone from the **AlliedSignal** RFI Project Manager should be documented in an additional memorandum.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the TriMatrix Laboratory QA Officer or ERM RFI Project Manager. If the problem is analytical in nature, information on these problems will be promptly communicated to **Allen Melcer** or **Greg Rudloff**, the U.S. EPA Project Coordinators and then to the U. S. EPA Quality Assurance Section. Implementation of corrective action will be confirmed in writing through the same channels.

Any non-conformance with the established quality control procedures in the QAPP or FSP will be identified and corrected in accordance with the QAPP. The **AlliedSignal** RFI Project Manager, or his designee, will issue a non-conformance report for each non-conformance condition.

13.1 FIELD CORRECTIVE ACTION

Corrective action in the field can be needed when the sample network is changed (i.e. more/less samples, sampling locations other than those specified in the QAPP, etc.), sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. Field and technical staff will be responsible for reporting all suspected technical or QA non-conformances or suspected deficiencies of any field activity or issued document by reporting the situation to the ERM RFI Coordinator or designee. The ERM RFI Coordinator or designee will be responsible for assessing the suspected problems in consultation with the ERM QA Director. A decision will be made based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable non-conformance requiring corrective action, then a non-conformance report will be initiated by the ERM RFI Coordinator or designee.

The ERM RFI Coordinator or designee will then be responsible for initiating corrective action for non-conformances by:

- evaluating all reported non-conformances;
- controlling additional work on non-conforming items;
- determining disposition or action to be taken;
- maintaining a log of non-conformances;
- reviewing non-conformance reports and corrective actions taken; and
- verifying that non-conformance reports are included in the final site documentation in project files.

If appropriate, the ERM RFI Coordinator or designee will see that no additional work that is dependent on the non-conforming activity is performed until the corrective actions are completed.

The ERM RFI Coordinator or designee is responsible for all site activities. In this role, the ERM RFI Coordinator at times is required to adjust the site programs to accommodate site specific needs. When it becomes necessary to modify a program, the responsible person notifies the ERM RFI Coordinator of the anticipated change and implements the necessary changes after obtaining the approval of the ERM RFI Coordinator. The change in the program will be documented on the field change request that will be signed by the initiators and the ERM RFI Coordinator. The field change request for each document will be numbered serially as required. The field change request shall be attached to the filed copy of the affected document. The ERM RFI Coordinator must approve the change in writing or verbally (followed by written notification) prior to field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and action taken.

The ERM RFI Coordinator or designee is responsible for controlling, tracking and implementing the identified changes. All changes will be reported by **AlliedSignal** in the monthly reports to the U.S. EPA contact, as discussed in Section 14 of the QAPP.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the U. S. EPA RCRA Project Coordinator.

13.2 LABORATORY CORRECTIVE ACTION

Corrective actions may be required for two classes of problems: analytical or equipment problems and noncompliance problems. Specific corrective actions are presented in the laboratory SOPs for each analytical method (Appendix A⁹). Specific corrective actions are not repeated in the text of this QAPP to avoid redundancy which could become burdensome during the RFI phase of corrective action, where the possible use of numerous additional analytical methods may be required.

Analytical or equipment problems may occur during sample preparation, laboratory instrumental analysis, or data review. Corrective measures for these types of problems are discussed in the following sections.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the TriMatrix Laboratory QA Officer or ERM Project Manager. Implementation of corrective action for noncompliance problems will be confirmed in writing through the same channels.

Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy;
- blanks contain target analyses above acceptable levels;
- undesirable trends are detected in spike recoveries or Relative Percent Difference
- between duplicates;
- there are unusual changes in detection limits;
- deficiencies are detected by the Laboratory QA Officer during internal or external audits or from the results of performance evaluation samples; or
- inquiries concerning data quality are received.

In addition, the data for equipment rinse blanks and trip blanks, etc., will be monitored for contamination, and corrective actions will be taken as soon as a problem is identified. This will be accomplished either by discontinuing the use of a specific bottle lot, contacting the bottle supplier(s) for re-testing the

⁹ Bound separately.

representative bottle from a suspect lot, re-sampling the suspected samples, validating the data taking into account that the contaminants could be introduced by the laboratory (i.e., common lab solvents, sample handling artifacts, etc.) or could be bottle QC problem, so as to make an educated determination of whether the bottles and hence the data are still usable, etc., whichever is appropriate.

For this particular project, the corrective actions will be conducted in a comprehensive manner in order to avoid the use of identified contaminated lot(s), and to ensure that the bottle supplier(s) is deemed responsive and able to provide clean bottles as specified.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, and checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the Laboratory Project Manager or Operations Manager. Once resolved, full documentation of the corrective action procedure is filed with the RFI QA Director.

13.3 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT

The TriMatrix Data Assessor may identify the need for corrective action during either the data validation or data assessment. Potential types of corrective action may include re-sampling by the field team or reinjection/re-analysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team, whether the data to be collected is necessary to meet the required quality assurance objectives (e.g. the holding time for samples is not exceeded, etc.) When the TriMatrix Data Assessor identifies a corrective action situation, it is the AlliedSignal RFI Project Manager who will be responsible for approving the implementation of corrective action, including re-sampling, during data assessment. All corrective actions of this type will be documented by the AlliedSignal RFI Project Manager. Another laboratory will not be used without written approval of the U.S. EPA.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The deliverables associated with the tasks identified in the RFI Work Plan and bimonthly progress reports will contain separate QA sections in which data quality information collected during the task is summarized. Those reports will be the responsibility of the AlliedSignal Project Manager and will include the TriMatrix Laboratory QA Officer report on the accuracy, precision, and completeness of the data as well as the results of the performance and system audits, and any corrective action needed or taken during the project, provided analytical data were generated during that period.

14.1 CONTENTS OF PROJECT QA REPORTS

The QA report (expected to cover one analytical event) will contain a discussion of any qualified data, provide justification for its use and/or if necessary, recommend that supplemental data be collected to replace the affected data set.

14.2 FREQUENCY OF QA REPORTS

Due to the limited scope of RFI, the QA reports will be provided on a bimonthly basis, along with the bimonthly progress reports described in Section 4.1 of the PMP.

14.3 INDIVIDUALS RECEIVING/REVIEWING QA REPORTS

All individuals identified in the Project Organization chart will receive copies of the bimonthly QA report.

TABLES

TABLE 1-1
Summary of Sampling and Analysis Program
RCRA Facility Investigation
Detroit Coke Facility
Detroit , Michigan

Location	Matrix	Sample Interval	Field Parameters	Laboratory Analysis ¹	Investigative	Duplicates	Blanks ²		MS/MSD	DQO
					Samples		Eq. Rins	Trip ¹		
Tar Tank Area	Soil	0-2 Feet ⁴	Visual, PID Screening	---	35	NA	NA	NA	NA	I
Tar Tank Area	Soil	0-2 Feet ⁴	Visual, PID Screening	U.S. EPA Methods 8260 & 8270, Metals	1	NA	NA	NA	NA	I
Tar Tank Area	Soil	0-2 Feet ⁴	Visual, PID Screening	Site Target List for Soils, as amended ³	8	1/10	1/10	NA	1/20	IV
By-Products Area	Soil	0-2 Feet	Visual, PID Screening	---	22	NA	NA	NA	NA	I
By-Products Area	Soil	0-2 Feet	Visual, PID Screening	U.S. EPA Methods 8260 & 8270, Metals	1	NA	NA	NA	NA	I
By-Products Area	Soil	0-2 Feet	Visual, PID Screening	Site Target List for Soils, as amended ³	5	1/10	1/10	NA	1/20	IV
SWMU 15	Soil	0-2 Feet	Visual, PID Screening	Site Target List for Soils, as amended ³	5	1/10	1/10	NA	1/20	I/IV
Background (BG-04)	Soil	0-2 Feet	Visual, PID Screening	U.S. EPA Method 8260 & Metals	1	1/10	1/10	NA	1/20	I/IV
Background	Soil	0-2 Feet	Visual, PID Screening	Site Target List for Soils, as amended ³	7	1/10	1/10	NA	1/20	I/IV
Tar Tank Area SWMUs	GW	---	---	Site Target List for GW, as amended ³	2	1/10	1/10	1/shipment	1/20	IV
Site Perimeter	GW	---	---	Site Target List for GW, as amended ³	9 Qtrly ⁵	1/10	1/10	1/shipment	1/20	IV
Outfall Discharge	GW	---	---	Site Target List for GW, as amended ³	2	1/10	1/10	1/shipment	1/20	IV
Upgradient Ground Water	GW	---	---	Site Target List for GW, as amended ³	2 ⁶	1/10	1/10	1/shipment	1/20	IV

NA - not applicable

¹ See Table 7-3 of the QAPP for parameter list.

² Equipment Rinse and Trip Blanks are aqueous samples and will be analyzed for VOCs only.

³ Site Target Lists include aromatic hydrocarbons and base/neutral/acid semivolatiles including pyridine, amended to include additional parameters based on the analytical results of the background and worst case soils from the two large SWMUs. The 7 background samples will only be analyzed for the amended parameters.

⁴ Sample interval is 0-2 feet below excavated depth of product in the Tar Tank Area SWMUs.

⁵ The perimeter well network will be sampled quarterly for one year.

⁶ Includes MW-4 and MW-5, the latter of which is sampled as part of the perimeter monitoring network.

TABLE 6 - 1
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification	Acceptance/ Rejection Criteria Initial Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
GC/MS-volatiles	SW-846 (8260)	5	%RSD <30% (CCC) 1,1-dichloroethene; chloroform 1,2-dichloropropane; toluene ethyl benzene; vinyl chloride RF> 0.30 (SPCC) chloromethane; 1,1-dichloroethane; bromoform (0.25); 1,1,2,2-tetrachloroethene; chlorobenzene	As needed	As needed	20%D	Every 12 hr.	CCC %D <25%. Same SPCC criteria as initial calibration

INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification	Acceptance/ Rejection Criteria Initial Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
GC/MS-semi-volatiles	SW846-8270	5	% RSD <30% (CCC) % RSD ≤40% (nonCCC) acenaphthene 1,4-dichlorobenzene hexachlorobutadiene N-nitroso-diphenylamine di-octylphthalate fluoranthene benzo(a)pyrene 4-chloro-3-methylphenol 2,4-dichlorophenol 2-nitrophenol phenol pentachlorophenol 2,4,6-trichlorophenol RF>0.05(SPCC) N-nitroso-n-dipropylamine hexachlorocyclopentadiene 2,4-dinitrophenol 4-nitrophenol	As needed	As needed	20%D	Every 12 hours	CCC %D <30%. Same SPCC criteria as initial cal. If continuing calibration verification result for non-CCCs is > +/- 40%, corrective action must be taken.

INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification	Acceptance/ Rejection Criteria Initial Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
Flame AA	SW-846	4	Correlation coefficient must be ≥ 0.995	At least daily, or as required (when CCV fails acceptance criteria).	Every calibration	90-110%R	Every 10 samples	90-110%R
Cold Vapor AA	SW-846	4	Correlation coefficient must be ≥ 0.995			80-120%R		80-120%R
ICP	SW-846	1	Not Applicable			90-110%R		90-110%R
Graphite Furnace AA	SW-846	4	Correlation coefficient must be ≥ 0.995			90-110%		90-110%

TABLE 7 - 1
ANALYTICAL METHODS AND DETECTION LIMITS

SOIL MATRIX

Parameter	SOP Name	Equivalent EPA Method	Detection Limit
USEPA Volatiles	Standard Operating Procedure for Modified Methods 8240 and 624.	8240	Table 7-3
USEPA Semivolatiles	Standard Operating Procedure for Modified Methods 8270 and 625	8270, 3550 Extraction	Table 7-3
Arsenic	Arsenic-Graphite Furnace Atomic Absorption Spectroscopy	7060, 3050 Digestion	0.10 mg/kg
Barium	Inductively Coupled Plasma Atomic Emission Spectroscopy	6010, 3050 Digestion	0.40 mg/kg
Cadmium	Cadmium-Direct Aspiration Atomic Absorption Spectroscopy	7130, 3050 Digestion	0.04 mg/kg
Cadmium	Inductively Coupled Plasma Atomic Emission Spectroscopy	6010, 3050 Digestion	0.04 mg/kg
Chromium	Inductively Coupled Plasma Atomic Emission Spectroscopy	6010, 3050 Digestion	1.6 mg/kg
Copper	Inductively Coupled Plasma Atomic Emission Spectroscopy	6010, 3050 Digestion	0.60 mg/kg
Lead	Inductively Coupled Plasma Atomic Emission Spectroscopy	6010, 3050 Digestion	1.0 mg/kg

TABLE 7 - 1
ANALYTICAL METHODS AND DETECTION LIMITS

SOIL MATRIX

Parameter	SOP Name	Equivalent EPA Method	Detection Limit
Mercury	Mercury Analysis of Soils, Sludges and Wastes by Manual Cold Vapor Technique	7471, Prep Method in 7471	0.10 mg/kg
Selenium	Selenium-Graphite Furnace Atomic Absorption Spectroscopy	7740, 3050 Digestion	0.50 mg/kg
Silver	Silver-Direct Aspiration Atomic Absorption Spectroscopy	7760, 3050 Digestion	0.20 mg/kg
Silver	Inductively Coupled Plasma Atomic Emission Spectroscopy	6010, 3050 Digestion	0.20 mg/kg
Zinc	Inductively Coupled Plasma Atomic Emission Spectroscopy	6010, 3050 Digestion	0.40 mg/kg
Percent Solids	% Total Solids, Gravimetric	160.3	0.1%

TABLE 7 - 2
SAMPLE CONTAINERS, PRESERVATIVES AND HOLDING TIMES

<i>Matrix</i>	<i>Parameter</i>	<i>Container</i>	<i>Preservation</i>	<i>Hold Times</i>	
				<u><i>Extraction</i></u>	<u><i>Analysis</i></u>
Water	Volatile Organics	2 x 40 ml Glass Septa Vial	HCl to pH <2 Cool to 4°C	—	14 days
Water	Semi-Volatile Organics	3 x 1 liter Amber Glass	Cool to 4°C	7 days	40 days
Soil	Volatile Organics	125 ml Glass Septa Vial	Cool to 4°C	—	14 days
Soil	Semi-Volatile Organics	500 ml Amber Glass	Cool to 4°C	14 days	40 days
Water	Metals (Except Hg)	500 ml plastic or glass	pH <2 HNO ₃	—	6 months
Water	Mercury	250 ml plastic or glass	pH <2 HNO ₃	—	28 days
Soil	Metals (Except Hg)	8 oz wide mouth	—	—	6 months
Soil	Mercury	8 oz wide mouth	—	—	28 days

All sample containers are purchased precleaned and certified as Level II by I-CHEM Inc.

TABLE 7 - 3
ORGANIC PARAMETERS AND DETECTION LIMITS¹

	Water (ug/l)	Soil (mg/kg)
Volatile Organic Compounds (8260)		
Acetone	50	0.10
Acetonitrile	10	0.10
Acrolein	5	0.01
Acrylonitrile	1	0.01
Benzene	1	0.01
Bromodichloromethane	1	0.01
Bromoform	1	0.01
Bromomethane	1	0.01
2-Butanone (MEK)	50	0.10
Carbon disulfide	50	0.10
Carbon tetrachloride	1	0.01
Chlorobenzene	1	0.01
2-Chloro-1,3-butadiene (Chloroprene)	5	0.01
Chloroethane	1	0.01
Chloroform	1	0.01
Chloromethane	1	0.01
3-Chloropropene (Allyl chloride)	10	0.01
Dibromochloromethane	1	0.01
1,2-Dibromo-3-chloropropane	1	0.01
1,2-Dibromoethane (Ethylene Dibromide)	1	0.01
Dibromomethane	5	0.01

¹ Detection limits may be elevated due to matrix interference. The listed values are consistent with Michigan Act 307 recommended method detection limits as specified in MERA Memorandum #14, Rev. 1, June 21, 1994

TABLE 7 - 3
ORGANIC PARAMETERS AND DETECTION LIMITS¹

	Water (ug/l)	Soil (mg/kg)
Volatile Organic Compounds (8260)		
trans-1,4-Dichloro-2-butene	5	0.01
Dichlorodifluoromethane	1	0.01
1,2-Dichlorobenzene	1	0.01
1,3-Dichlorobenzene	1	0.01
1,4-Dichlorobenzene	1	0.01
1,1-Dichloroethane	1	0.01
1,2-Dichloroethane	1	0.01
1,1-Dichloroethylene	1	0.01
cis-1,2-Dichloroethylene	1	0.01
trans-1,2-Dichloroethylene	1	0.01
Dichloromethane (Methylene Chloride)	1	0.01
1,2-Dichloropropane	1	0.01
cis-1,3-Dichloropropene	1	0.01
trans-1,3-Dichloropropene	1	0.01
1,4-Dioxane	50	0.10
Ethylbenzene	1	0.01
2-Hexanone	50	0.10
Iodomethane	5	0.01
Methacrylonitrile	50	0.10
4-Methyl-2-pentanone (MIBK)	50	0.10
2-Methyl-1-propanol (Iso-butyl alcohol)	500	1.0
Propionitrile	50	0.10
Styrene	1	0.01
1,1,1,2-Tetrachloroethane	1	0.01
1,1,2,2-Tetrachloroethane	1	0.01
Tetrachloroethylene	1	0.01
Toluene	1	0.01

TABLE 7 - 3
ORGANIC PARAMETERS AND DETECTION LIMITS¹

	Water (ug/l)	Soil (mg/kg)
Volatile Organic Compounds (8260)		
1,1,1-Trichloroethane	1	0.01
1,1,2-Trichloroethane	1	0.01
Trichloroethylene	1	0.01
Trichlorofluoromethane	1	0.01
1,2,3-Trichloropropane	1	0.01
Vinyl acetate	50	0.10
Vinyl chloride	1	0.01
Xylene (Total)	3	0.03
Semi-Volatile Organic Compounds (8270)		
Acenaphthene	5	0.330
Acenaphthylene	5	0.330
Acetophenone	10	0.330
2-Acetylaminofluorene	50	2.0
4-Aminobiphenyl	10	0.330
Aniline	5	1.7
Anthracene	5	0.330
Aramite	50	2.0
Benzo(a)anthracene	5	0.330
Benzo(b&k)fluoranthene	5	0.330
Benzo(g,h,i)perylene	5	0.330
Benzo(a)pyrene	5	0.330
Benzyl alcohol	50	1.3
Bis(2-chloroethoxy)methane	5	0.330
Bis(2-chloroethyl)ether	5	0.330
Bis(2-chloroisopropyl)ether	5	0.330

TABLE 7 - 3
ORGANIC PARAMETERS AND DETECTION LIMITS¹

	Water (ug/l)	Soil (mg/kg)
Semi-Volatile Organic Compounds (8270)		
Bis(2-ethylhexyl)phthalate	5	0.330
4-Bromophenyl phenyl ether	5	0.330
Butyl benzyl phthalate	5	0.330
2-sec-Butyl-4,6-dinitrophenol	5	2.0
p-Chloroaniline	20	1.3
4-Chloro-3-methylphenol	5	0.330
2-Chloronaphthalene	5	0.330
2-Chlorophenol	5	0.330
4-Chlorophenyl phenyl ether	5	0.330
Chrysene	5	0.330
Dibenzo(a,h)anthracene	5	0.330
Dibenzofuran	5	0.330
Di-n-butyl phthalate	5	0.330
3,3'-Dichlorobenzidine	20	2.0
2,4-Dichlorophenol	5	0.330
Diethylphthalate	5	0.330
p-(Dimethylamino)azobenzene	10	0.330
7,12-Dimethyl benz(a)anthracene	10	0.330
3,3'-Dimethylbenzidine	50	2.0
2,2-Dimethylphenethylamine	20	0.70
2,4-Dimethylphenol	5	0.330
Dimethylphthalate	5	0.330
1,3-Dinitrobenzene	5	0.330
4,6-Dinitro-2-methylphenol	20	1.7
2,4-Dinitrophenol	20	1.7
2,4-Dinitrotoluene	5	0.330
2,6-Dinitrotoluene	5	0.330

TABLE 7 - 3
ORGANIC PARAMETERS AND DETECTION LIMITS¹

	Water (ug/l)	Soil (mg/kg)
Semi-Volatile Organic Compounds (8270)		
Di-n-octylphthalate	5	0.330
Diphenylamine	10	0.330
Ethylmethacrylate	50	2.0
Ethyl methanesulfonate	10	1.0
Fluoranthene	5	0.330
Fluorene	5	0.330
Hexachlorobenzene	5	0.330
Hexachlorobutadiene	5	0.330
Hexachlorocyclopentadiene	5	0.330
Hexachloroethane	5	0.330
Hexachlorophene	*	*
Hexachloropropene	50	2.0
Indeno (1,2,3-cd)pyrene	5	0.330
Isophorone	5	0.330
Isosafrole	20	0.70
Methapyrilene	10	1.0
3-Methylcholanthrene	50	2.0
Methylmethacrylate	50	2.0
Methyl methane sulfonate	50	2.0
2-Methylnaphthalene	5	0.330
2-Methylphenol	5	0.330
3-Methylphenol ²	5	0.330
4-Methylphenol ²	5	0.330
Naphthalene	5	0.330
1,4-Naphthoquinone	1000	30
1-Naphthylamine	50	2.0

TABLE 7 - 3
ORGANIC PARAMETERS AND DETECTION LIMITS¹

	Water (ug/l)	Soil (mg/kg)
Semi-Volatile Organic Compounds (8270)		
2-Naphthylamine	50	2.0
2-Nitroaniline	20	1.7
3-Nitroaniline	20	1.7
4-Nitroaniline	20	1.7
Nitrobenzene	5	0.330
2-Nitrophenol	5	0.330
4-Nitrophenol	20	1.7
4-Nitroquinoline-1-oxide	500	20
N-Nitrosodi-n-butylamine	20	0.90
N-Nitrosodiethylamine	50	2.0
N-Nitrosodimethylamine	5	0.330
N-Nitrosodiphenylamine	5	0.330
N-Nitrosodi-n-propylamine	5	0.330
N-Nitrosomethylethylamine	50	2.0
N-Nitrosomorpholine	20	0.70
N-Nitrosopiperidine	20	0.70
N-Nitrosopyrrolidine	20	0.70
N-Nitro-o-toluidine	10	0.330
Pentachlorobenzene	5	0.330
Pentachloroethane	50	2.0
Pentachloronitrobenzene	20	0.50
Pentachlorophenol	1	1.7
Phenacetin	10	0.330
Phenanthrene	5	0.330
Phenol	5	0.330
p-Phenylenediamine	*	*
2-Picoline	20	0.70

TABLE 7 - 3
ORGANIC PARAMETERS AND DETECTION LIMITS¹

	Water (ug/l)	Soil (mg/kg)
Semi-Volatile Organic Compounds (8270)		
Pronamide	10	0.330
Pyrene	5	0.330
Pyridine	10	0.330
Safrole	10	0.330
1,2,4,5-Tetrachlorobenzene	10	0.50
2,3,4,6-Tetrachlorophenol	50	2.0
o-Toluidine	10	0.330
1,2,4-Trichlorobenzene	5	0.330
2,4,5-Trichlorophenol	50	1.7
2,4,6-Trichlorophenol	5	0.330
sym-Trinitrobenzene	20	0.70

*These compounds have been demonstrated to be difficult to extract from water.

Notes:

- (1) Detection Limits are highly matrix dependent. The above values are intended for guidance and may not be technically achievable.
- (2) The compounds 3-Methylphenol and 4-Methylphenol will be reported as a sum.

TABLE 8 - 1

**METHOD SPECIFIC DATA QUALITY OBJECTIVES
MATRIX SPIKE AND DUPLICATE CONTROL LIMITS**

Parameter	Soil Matrix		Water Matrix	
	Precision	Accuracy	Precision	Accuracy
1,1-Dichloroethylene	22%	64-143%	25%	63-140%
Trichloroethylene	24%	68-132%	22%	66-128%
Chlorobenzene	20%	68-126%	22%	67-125%
Toluene	18%	73-134%	22%	70-129%
Benzene	20%	70-128%	21%	68-128%
1,2,4-Trichlorobenzene	25%	27-108%	17%	34-113%
Acenaphthene	22%	34-103%	21%	33-113%
2,4-Dinitrotoluene	21%	38-110%	20%	33-122%
Pyrene	21%	40-119%	22%	33-133%
N-Nitroso-di-n-propylamine	29%	31-121%	22%	40-125%
1,4-Dichlorobenzene	35%	16-111%	26%	33-109%
Pentachlorophenol	36%	1-120%	41%	21-137%
Phenol	29%	21-114%	39%	5-66%
2-Chlorophenol	27%	27-105%	31%	30-109%
4-Chloro-3-methylphenol	20%	39-113%	20%	36-115%
4-Nitrophenol	33%	20-124%	53%	3-73%

TABLE 8 - 2**METHOD SPECIFIC DATA QUALITY OBJECTIVES
SURROGATE COMPOUND PERCENT RECOVERY CONTROL LIMITS²**

Method	Parameter	Soil	Water
8260	4-Bromofluorobenzene	71-113	87-108
8260	Dibromofluoromethane	84-122	89-118
8260	Toluene-d ₈	84-110	87-111
8270	Nitrobenzene-d ₅	21-100	41-99
8270	2-Fluorobiphenyl	36-102	34-109
8270	o-Terphenyl	27-117	34-128
8270	Phenol-d ₆	20-95	5-50
8270	2-Fluorophenol	25-89	12-72
8270	2,4,6-Tribromophenol	23-110	31-118

² Control Limits are subject to change and are updated every 4-6 months.

TABLE 10 - 1
TriMatrix ANALYTICAL SERVICES
Internal Laboratory Audit Record
Sample Receiving/Log-in

Audit Date: _____
Auditor: _____

m/ Description

Yes

No

Training records maintained and up to date?

--	--

SOP's for sample receiving and sample log-in documented and where are they stored?

--	--

pH checked on all chemically preserved samples and recorded correctly?

--	--

Cooler temperatures checked for each set of samples received and documented on pH/Temp log form?

--	--

Excursions in cooler temperatures and analytical preservations properly noted?

--	--

COC forms accompany each submittal of samples?

--	--

Volatile samples logged in meticulously?

--	--

Volatile water samples stored separate from soils and wastes?

--	--

Temperatures monitored daily for each fridge refrigerator and is the thermometer immersed in a liquid?

--	--

TABLE 10 - 1
TriMatrix ANALYTICAL SERVICES
Internal Laboratory Audit Record
Sample Receiving/Log-in

Audit Date: _____
 Auditor: _____

m/ Description

Yes

No

Temperature excursions and corrective
 actions noted in the temperature log book?

--	--

Each lot of pH test strips checked for
 accuracy against known standards?

--	--

Chemical preservatives monitored for
 expiry?

--	--

TABLE 10 - 1

TriMatrix ANALYTICAL SERVICES

Internal Laboratory Audit Record

GC/MS Laboratory

Audit Date: _____

Auditor: _____

m/ Description

Yes

No

training records maintained and up to
date?

MDL studies been performed for each
analyte, analytical technique and instrument?

MDL studies been updated within the
12 months?

stock standard numbers assigned and
recorded in a stock standard log book?

working standards assigned and
recorded in a working standard log book?

instrument maintenance activities
recorded in a maintenance log for each
instrument?

preventative maintenance procedures
performed as recommended by the
instrument manufacturer?

all reagents properly labeled with date
receipt or formulation, record number
opened and expiration date?

manufactures operating manuals
available to the analysts?

other log books, i.e. balance, pipet etc.,
available and in use in this area?

TABLE 10 - 1

TriMatrix ANALYTICAL SERVICES

Internal Laboratory Audit Record

GC/MS Laboratory

Audit Date: _____

Auditor: _____

m/ Description

Yes

No

e all raw data printouts initialed at the time
review?e instrument conditions documented
each analytical run?e all benchsheets and related records,
t and maintained in an orderly manner?e the area supervisor reviewed and initialed
record books for their laboratory area?e laboratory control samples (LCS's)
method preparation blanks (MPB's)
lyzed with each batch of samples?initial and continuing calibrations
formed as outlined in the analytical
hods?laboratory established control
dows utilized for the monitoring of
method and matrix QC?corrective actions documented when QC's
to meet establish acceptance criteria?analyst notebooks maintained by
analyst for this lab area?

TABLE 10 - 1
TriMatrix ANALYTICAL SERVICES
Internal Laboratory Audit Record
GC/MS Laboratory

Audit Date: _____
 Auditor: _____

Item/ Description

Yes

No

Are surrogates used in all analytical procedures for this lab area?

Are corrective actions well documented when surrogate compounds fall outside established windows?

Are CCC's and SPCC's within established method control limits on a daily basis?

Are corrective actions adequate when internal standard is out of control?

Are the frequency of calibrations and instrument tuning adequate?

Are QC samples performed at the appropriate frequency as outlined in the analytical SOP and QA manual?

Are the correct qualifiers and procedures used to qualify data points that fall outside established control limits?

Are permanent records maintained for all raw data printouts and electronic files?

Is the data review process adequate to detect any anomalies or errors in the analytical process?

TABLE 10 - 1
TriMatrix ANALYTICAL SERVICES
Internal Laboratory Audit Record
Extraction Laboratory

Audit Date: _____
Auditor: _____

Item/ Description

Yes

No

Are training records maintained and up to date?

Are extraction hold times met for each method and matrix type?

Is the general work area maintained in a clean and orderly manner?

Are stock standard numbers assigned and recorded in a stock standard log book?

Are QC samples extracted at the appropriate frequency as outlined in the analytical SOP and QA manual?

Are toxic chemicals handled in a safe manner?

Are documents, reagent containers and software properly labeled with all appropriate information?

Are all reagents properly labeled with date received or formulation, record number, lot opened and expiration date?

Are other log books, i.e. balance, pipet etc., available and in use in this area?

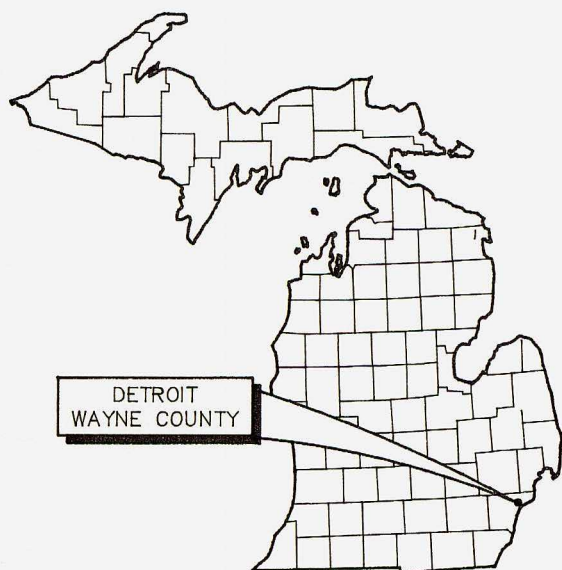
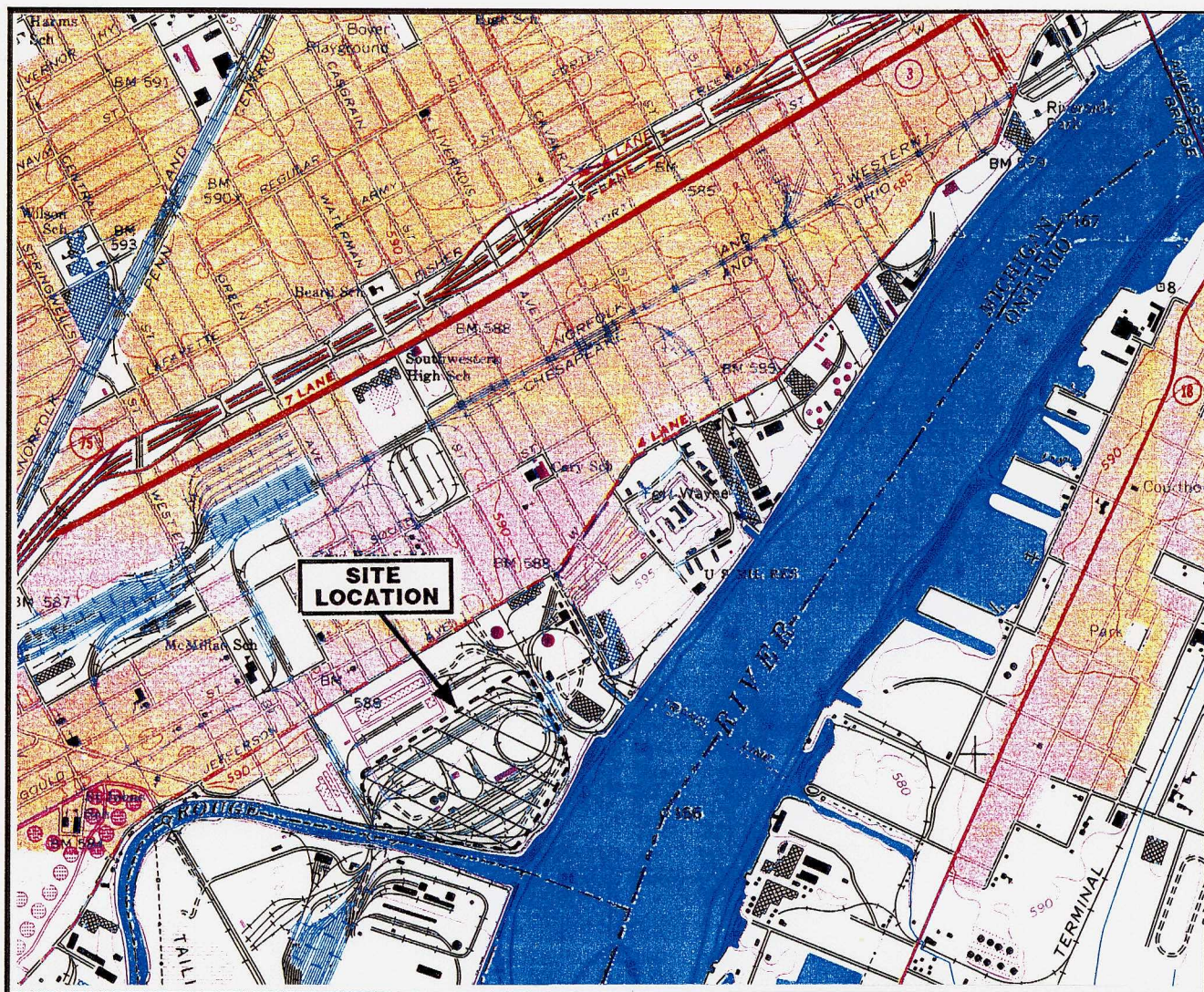
TABLE 11 - 1
PREVENTIVE MAINTENANCE
PROCEDURES AND SCHEDULES

Instrument	Maintenance Procedures/Schedule	Spare Parts in Stock
Gas Chromatograph/ Spectrometer (GC/MS)	<ol style="list-style-type: none"> 1. Replace pump oil as needed. 2. Change septa weekly or as often as needed. 3. Replace electron multiplier as often as needed. 4. Replace gas jet separator as needed. 5. Replace GC injector glass liner weekly or as often as needed. 6. Replace GC column as needed. 7. Check to ensure that gas supply is sufficient for the day's activity. 	<ol style="list-style-type: none"> 1. Syringes 2. Septa 3. Various electronic components 4. Glass jet separator 5. GC column 6. Glass liner
Purge and Trap Sample Concentrator	<ol style="list-style-type: none"> 1. Replace trap as needed. 2. Decontaminate the system after running high concentration samples or as required by blank analysis. 3. Leak check system daily and as often as needed. 4. Check to ensure the gas supply is sufficient for the day's activity. 	<ol style="list-style-type: none"> 1. Spare traps 2. Spare sparger 3. Various electronic components/circuits 4. Plumbing supplies-tubing fitting
Photoionization Detector	<ol style="list-style-type: none"> 1. Calibrate at least once per day of use. 2. Recharge one batter pack for each eight hours of field use. 3. Clean detector lamp once per 24 hours of use or more frequently if needed. 4. Change in-line dust filter once for every 240 hours of use or more frequently if needed. 	<ol style="list-style-type: none"> 1. Zero air and isobutylene span gas canisters 2. Battery packs and AC outlet. 3. Lint free cloth and methanol 4. Replacement in-line filter

TABLE 11-1
PREVENTIVE MAINTENANCE
PROCEDURES AND SCHEDULES
 (cont.)

Instrument	Maintenance Procedures/Schedule	Spare Parts in Stock
Graphite Furnace	1. Change graphite contact rings and tubes as needed.	1. Contact rings and
Atomic Spectrophotometer (GFAA)	2. Clean quartz window as necessary. 3. Check to ensure the gas supply is sufficient for the day's activity. 4. Change gas and instrument filters as needed.	
Mercury Analyzer	1. Clean tubing and quartz cell as often as needed. 2. Check to ensure the gas supply is sufficient for the day's activity. 3. Change gas and instrument filters as needed.	1. Quartz cells
ICP	1. Change peristaltic tubing every 8 hours. 2. Change gas and instrument filters as needed. 3. Check to ensure the gas supply is sufficient for the days activities.	
Flame Atomic Absorption	1. Check to ensure the gas supply is sufficient for the days activities. 2. Clean quartz window as necessary. 3. Change D ₂ background correction lamp.	

FIGURES



HORIZON ENVIRONMENTAL

DETROIT COKE CORPORATION
DETROIT, MICHIGAN

SITE LOCATION MAP

PROJECT NUMBER:
DET-0101

FIGURE:

1-1

DECEMBER, 1994

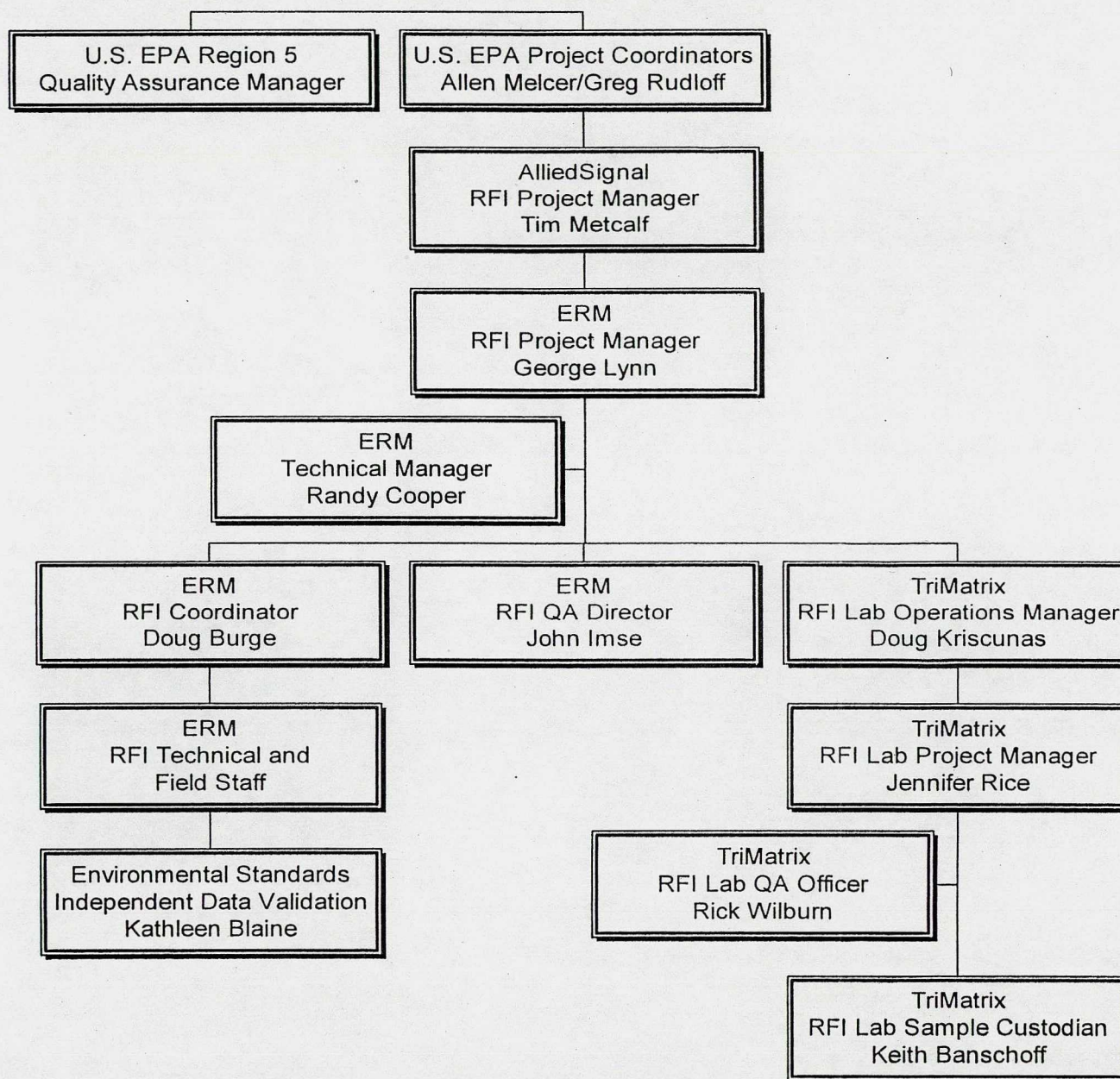
FIGURES

Figure 1-2
PROJECT SCHEDULE
DETROIT COKE FACILITY RFI

DESCRIPTION	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16
ent Preparation and Mobilization	■															
k Cleanout		■	■	■	■	■	■									
id Piping Removal			■	■	■	■	■									
oval from Tar Tank Area SWMUs				■	■	■	■									
vestigation					■	■	■	■	■	■						
oring Well Installation					■	■	■									
ndwater Sampling						■	■	■								
ill Sampling							■									
Sampling							■	■	■	■						
ratory Analysis						■	■	■	■	■	■	■				
ident Data Validation									■	■	■	■	■	■		
aluation and Preparation of									■	■	■	■	■	■	■	
Report																
ignal Review of Draft RFI Report														■	■	■
ition of Final RFI Report																■
ittal of Final Report to U.S. EPA																■

ule assumes one month for tank/piping and tar removal subcontractor selection prior to project startup.

FIGURE 2-1
QUALITY ASSURANCE AND MANAGEMENT RESPONSIBILITIES
DETROIT COKE FACILITY RFI



APPENDICES

Appendix A

Earth Tech ELD SOPs

EPA Method 8240
Benzene, Toluene, Ethylbenzene, and Xylene

Ex. 4

Ex. 4

Ex. 4

Ex. 4

Ex. 4

Ex. 4

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